

HIGHLIGHTS FROM THE STATE OF THE

ENVIRONMENT

REPORT: AN ENVIRONMENTAL HEALTH PERSPECTIVE



In the last two decades, Ottawa-Carleton's residents and municipal governments have realized a new awareness of environmental issues. Ecology – the relationship between all the elements in an environment, including geology, climate, plants, animals and human beings – is no longer a fringe issue. It is a consuming concern. It is very clear that our relationship with the environment requires greater sensitivity to the complex interactions between these elements.

The Regional Municipality of Ottawa-Carleton's Health Department is a strong link in our relationship to the environment around us. Committed to the promotion of optimal health through leadership, innovation and service, the Health Department works to preserve our quality of life as the population of the Region increases. As well, the provincial government requires each Health Department in the province to produce a report on local environmental risks at least once every five years, with annual updates. The 1991 State of the Environment Report is the Regional Health Department's first such report and helps us fulfill this mandate.



The State of the Environment Report is a snapshot of how current conditions affect health, with some guidelines for future action. It responds to public concerns about the environment and details our current knowledge about many of the factors affecting our air, water and land.

In each case, we describe potential health hazards, identify issues that might be of concern, and present relevant data on the subject. Environmental findings,

such as the amount of lead in residential water, are compared to federal and provincial regulations. The criteria in these regulations, often referred to as "guidelines" or "objectives", change as we learn more about the chemicals and technologies we use in our everyday lives, and about the environment itself.

Much remains to be learned. Sometimes the health effects of a particular chemical or technology are not known. In other cases,

the quantity of a particular chemical or prevalence of a particular procedure are not known or specific data for Ottawa-Carleton may not be available. For example, an environmental concern such as "sick building syndrome" is recognized, but we do not yet have the technology to define or remedy the cause. Nevertheless, **documenting the knowledge we do have is an important step in making a change.**

Past experience in Ottawa-Carleton has shown that residents, municipal governments and townships can work together to change our environment for the better. Reports such as the 1991 State of the Environment document these efforts and offer guidance for our future endeavours.

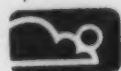
Our next step is to set priorities and address the issues. We will look to the Regional Health Committee to guide us, and to the Environmental Health Advisory Committee (made up of representatives from the community and all three levels of government) and other members of the community to help us as we progress. ●

Dr. S.J. Corber
Medical Officer of Health

The full State of the Environment Report in English only and additional copies of the Highlights may be obtained from:
Ottawa-Carleton Health Department, Communications, 495 Richmond Road, Ottawa, Ontario K2A 4A4 (613) 722-2328



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Outdoor Air Quality



Outdoor air quality in the Region is very good most of the time. Occasionally, it suffers from poor air quality episodes but these are rare, and usually confined to hot, windless summer days. With little industry to create large point sources of air pollution, and with sufficient natural ventilation, most air pollution in the Region is dispersed before it affects ambient air quality. The combination of weather conditions, the intensity of emissions and the location of air pollution sources determine the ambient air quality on any given day. We are also affected by pollution sources outside of the Region, which contribute to ozone pollution and odours.

"Poor" air quality is most often the result of high

ozone levels. Suspended particulates such as dust, pollen and diesel exhaust are the second most common cause of air quality problems. Ambient levels of carbon monoxide, sulphur dioxide and particulate lead in outdoor air have been decreasing in the Region over the past decade.

The air quality for Ottawa-Carleton is monitored at the MacDonald Gardens

Air Monitoring Station on a continuous basis. The air quality in Ottawa-Carleton falls into the top rating of the air quality index 89.6 per cent of the time.

The urban centres in the Region are also affected by local air pollution sources. **Up to 75 per cent of air pollution in urban centres is attributed to motor vehicles.** Car, bus and truck exhaust

contains both primary pollutants such as carbon monoxide, hydrocarbons, oxides of nitrogen and carbon dioxide, and secondary pollutants such as ozone, a photochemical oxidant. Buses and cars with diesel engines emit 50 to 80 times more particulates than gasoline-fuelled engines.

Thanks to stricter standards for cars and to reduction in the lead content in gasoline, automobile pollution emission rates have decreased by over 40 per cent in the past decade. However, at the same time, there has been 12 per cent increase in traffic on Ottawa-Carleton and Outaouais roads. Achieving even lower air pollution levels requires reducing the number of cars on the road and further tightening air pollution standards for all vehicles.

Other urban pollution sources include home heating systems, commercial and industrial emissions, and natural sources. ●

MacDonald Gardens Air Monitoring Station

AQI Reading	Number of Hours in 1989	Percentage of Time
Very Good (0-15)	7829	89.6 %
Good (16-31)	876	10.0 %
Moderate (32-49)	36	0.4 %
Poor (50-99)	0	0.0 %
Very Poor (100 +)	0	0.0 %

AQI is the air quality index.



Indoor Air Quality

Before the advent of sealed office buildings and airtight homes, indoor air quality was not considered a problem. Now, the indoor environment can have a significant bearing on our health. Prolonged stays in contaminated home or office environments can cause health problems.

Knowledge about how interior air pollution affects health and the extent of the problem in Ottawa-Carleton is still incomplete. However we do know that indoor air can be contaminated by such substances as second-hand smoke, radon gas, as-

bestos particles or urea formaldehyde insulation. Airtight buildings concentrate stale air and airborne chemicals to the detriment of human health. This phenomenon has given rise to the term 'sick building syndrome'.

Indoor air contains outdoor air pollutants, as well as pollutants from indoor activities. Indoor sources include carbon monoxide and carbon dioxide from heating and cooking appliances, radon gas from uranium deposits in the ground and in building materials, volatile organic compounds from building materials and furnishings,

particulates from cigarette smoke and asbestos, nitrogen oxides from gas stoves, and microorganisms from humans, pets and humidifiers. The most common outdoor air pollutants include ozone, suspended particulates such as pollen and dust, carbon monoxide, sulphur dioxide and particulate lead.

Individual sensitivity to air pollutants varies greatly from person to person. As the quantity and variety of chemicals used in our society increases, and as the push to conserve energy results in buildings with less and less natural air inflow, our

exposure to pollution also increases. More people are now reporting sensitivities and allergies to these pollutants.

Ventilation, air cleaning, and removing or isolating pollution sources are the three main ways to ensure adequate indoor air quality. However, because every indoor environment is different, it is difficult to design one solution for all 'sick' buildings. Reducing ill effects from indoor pollution will require improvements in documenting its components and effects, then designing specific solutions. ●



Drinking Water Quality

Insuring the provision of clean, safe drinking water through monitoring is a core public health responsibility. The Ottawa River supplies our Region with a relatively clean source of drinking water. This is due to its large size and flow, and the lack of heavy industry and development in the drainage basin upstream of Ottawa-Carleton. **The Regional water supply meets all federal and provincial drinking water safety standards;** its microbiological safety is ensured by disinfection at two water treatment plants. Disinfection at the Regional plants starts with chlorinating the raw water

and ends with another dose of chlorine before it enters the distribution system. **Post-chlorination**

dosing has increased over the years in response to expansion of the the distribution sys-

tem. This prevents the resurgence of organisms at the far reaches of the system.



Chemical water quality is measured in parts per billion. Trace amounts of pesticides and organics such as phthalates are occasionally found in the drinking water supply but are at levels well below the Ontario and Canadian drinking water standards. Trihalomethanes (THMs) are a by-product of the disinfection process.

THMs are present in our water at higher levels than in other Ontario drinking water supplies, but are still within the



Drinking Water Quality continued

guidelines. These elevated levels are likely due to the high quantity of organic impurities in the raw water supply and the increasingly high post-chlorination residuals maintained by the Region.

Plans are underway for a pilot water-treatment plant to test alternative water treatment techniques, with special attention given to bringing the Region's trihalomethane level down to that of other municipal supplies.

Lead and aluminum are two other contaminants that are by-products of treatment and distribution. These meet drinking water guidelines but are a concern due to their potential human health impact. Radiation levels are well below objective levels.

Rural residents rely on ground water drinking water supplies, either from shallow wells or from deeper drilled wells. **Shallow wells in the Region are susceptible to bacteriological contamination**

due to nearby deteriorating septic systems. Increases in rural development in small communities are also putting pressure on limited water supplies. Several rural communities have a high incidence of bacterially contaminated wells. Nitrates are also a concern in some areas where fertilizers and/or sewage effluent have contaminated the aquifer. Well treatment devices, communal wells and deeper wells have corrected most known problems.

Drilled wells in the Region are usually not affected by bacterial contamination but some contain high levels of aesthetically bothersome chemicals. Minerals such as iron, salts and sulphur give unpleasant tastes and smells to water in some area wells. High levels of calcium and magnesium are responsible for 'hard' water, which clogs pipes and reduces the effectiveness of soaps and detergents. ●



Recreational Water



Both the Ottawa and Rideau rivers are used extensively for recreation. In the past decade, urban pollution has resulted in periodic beach closures.

Water quality generally deteriorates as rivers pass through urban centres. Out-of-town beaches are not affected by bacterial contamination and remain open to the public throughout the bathing season.

Several groups monitor water quality and investigate all instances of pollution. This has reduced the pollution from known sources and allowed beach water quality to remain relatively constant over the years despite the pressure of urban pollution. The technology of predicting and evaluating recreational water quality is constantly improving, allowing the Health Department to reduce residents' expo-

sure to water pollution.

Increasing levels of bacteria, suspended solids and phosphates in the Rideau River have prompted concerned residents and agencies to step up efforts to solve deteriorating water quality. The smaller size of the Rideau makes it more susceptible to pollution. Mercury contamination of sport fish in this watercourse has resulted in consumption guidelines.

In rural areas, the river is polluted by inadequate rural sewage treatment plants, agriculture and the forestry industry. Programs are in place to reduce pollution from all of these sources.

In urban areas, inadequate treatment of sewage, overflow into the stormwater system, and disposal of chemicals into the sewage system by industry (in particular the electronics industry) are a concern. Regional pollution-control initiatives in the urban area include an improved and expanded sewage plant, higher standards for stormwater systems in new developments, and replacing the older combined stormwater/sewage systems. ●



Greenspaces

Ottawa-Carleton has rich expanses of publicly owned park land, natural areas and open space. This greenspace contributes to the quality of life we enjoy and is important for both physical health and emotional well-being. Most residents live less than half an hour away from natural areas where one can hike through nature trails and bird watch or enjoy beautiful scenery.

Greenspace planning by the federal government



began in the late 1890s when the precursor of the National Capital Commission was created. The Region is fortunate to have had the benefit of this early planning and continued maintenance of this park land. The province maintains two provincial parks and six conservation areas within the Region. The municipalities are also very active in providing recreational parks and facilities for residents. ●



Solid Waste Management

Proper management of all types of solid waste is important for the maintenance of public health. Improper waste management can lead to biological and chemical contamination of land, water or air.

Our attitudes to waste disposal have changed drastically in the last 20 years, especially with respect to its environmental impact. Thus, the solid waste manager of today must simultaneously cope with past mistakes, present concerns and future needs.

Solid wastes degrade chemically and biologically to produce solid, liquid and gaseous products. Factors affecting decomposition include the mix of waste; its physical, chemical and biological properties; oxygen; moisture content; temperature; and microbial population.

The three major health concerns associated with landfill sites are:

- a) Leachate contamination of surface and ground water and wells - usually a rural problem.
- b) Methane gas production - usually a problem in developed areas.
- c) Soil contamination by hazardous waste - this becomes a problem when land is used for another purpose or when groundwater drinking supplies are affected.

Leachate is produced when surface water percolates through landfill, extracting microorganisms and water-soluble chemicals from the solid waste. Leachate can also contain toxic organic and inorganic chemicals that have been thrown away. If the ground under the landfill

is permeable, the leachate can enter the water table, contaminating it.

When the oxygen content of a landfill is depleted, methane and carbon dioxide gases are produced by microbial decomposition of the waste. The rate of methane production depends on the type of waste, its temperature and moisture content. Methane generation can continue for up to 100 years after a landfill is closed. Methane gas is lighter than air and, when the conditions allow, it escapes the waste site. In some geological settings, where more permeable materials confine the waste, it is easier for the methane to escape. If it seeps into confined spaces under buildings, for example, there is some possibility of explosion.

Proper design of landfill

sites can prevent the problems associated with leachate and methane gas.

The Ontario Ministry of the Environment is responsible for assessing the environmental and health hazard potential of inactive and active landfill sites. **The Region knows of 79 inactive landfills, but because historical records of old dump sites are sketchy, it's impossible to say whether there are more. Forty-four sites located within the City of Ottawa have been evaluated for methane gas risk. There has been no extensive environmental evaluation of rural landfill sites.**

There are now five active sanitary landfills within the Region. Four of the sites are monitored continuously. At three of these sites - Laidlaw, Huneault



Solid Waste Management *continued*

and Trail Road – remedial action has dealt with leachate or methane gas migrating off-site. The Almonte site does not require reme-

for the future, the Region's waste management master plan is currently in its initial stages. An important part of the

25 per cent of all wastes from landfill and 50 per cent by 2000. The Regional and municipal governments are working to-

dertaken many initiatives already, including single-container week, telephone book recycling, publication of a directory of recycling businesses in the Region, and hosting several household environmental clean-up days.

A permanent site for hazardous home waste disposal should be available to the public by the end of 1991. In 1987, a U.S. survey on hazardous products in the home found that most homes stored paint products (21.1%), insecticides (13.9%), cleaners (10.5%) and car products (10%). This also seems typical of any household in Ottawa-Carleton. Hazards from these products include inflammability, combustibility, skin and eye irritation, and harm or fatality if the products are swallowed. Ottawa-Carleton municipalities are also active in recycling programs as outlined in the table. ●



dial action at this time. The Springhill site has undergone a preliminary hydrogeological assessment and a report is due in 1991.

Vigilant monitoring of these landfill sites is essential to ensure that there are no adverse health effects. Even more importantly, the amount of waste sent to the landfill sites must be reduced. This is the responsibility of every resident, municipality, township and business.

As current landfill sites near capacity, solid waste management is an increasing concern. To prepare

master plan is the development of waste diversion programs. The Ontario government has targeted 1993 for the diversion of

together to reach this goal. Programs include hazardous waste facilities, composting and recycling programs. The Region has un-

Municipal Recycling Programs

Municipality	Joined Bluebox Program	Items Collected in Bluebox Program	Other Recycling Programs
Cumberland	Sept 1988	1,2,3,4,5	Composters, Xmas trees
Gloucester	June 1987	1,2,3,5	Composters, Xmas trees
Goulbourn	April 1990	1,2,3,5	Composters
Kanata	June 1988	1,2,3,5	Recycling depot, Composters, Xmas trees, Leaves, Used clothing
Nepean	June 1987	1,2,3,4	Composters, Education, Xmas trees
Osgoode	Sept 1989	1,2,3,5	No other programs
Ottawa	June 1987	1,2,3,4	Composters, Xmas trees, Leaves, Used clothing
Rideau	****	****	Recycling depot
Rockcliffe Park	Jan 1990	1,2,3,5	Composters
Vanier	May 1991	1,2,3,5	Composters
West Carleton	****	****	Recycling depot, Composters, Xmas trees, Leaves, Used clothing

1 newspaper; 2 glass bottles; 3 metal and aluminum cans; 4 motor oil; 5 clear plastic bottles



Tires

Since the Hagersville tire fire, the disposal of tires has become an important waste management issue. Under the Ontario Fire Code, tire piles are limited to 5000 tires – a pile approximately 10 by 10 by 3 metres. As of October 1, 1990, tire sites with more

than 5000 tires must apply to the Ministry of Environment for a permit as a waste disposal site.

Currently, no Regional landfill site except Trail Road accepts tires. Four tire sites in Ottawa-Carleton are certified. At these

locations, tires are buried or otherwise contained to reduce fire hazard. The Ministry of the Environment has inspected these sites and found them satisfactory. At two other sites that are not yet certified, the province is providing

security guards until the tires are properly contained. The Regional Environmental Services Department is prepared to deal with all stockpiles within the Region once a provincial disposal policy is announced. ●



Snow

Snow disposal can contaminate the soil and nearby surface and ground water. **The major environmental contaminants in urban snow are chlorides, sodium, calcium, lead and suspended solids.** The contaminants come mainly from chemical de-icers and automobile exhaust. The following table compares the composition of snow in a 1989 study with that of a 1973 study.

There has been a significant decrease in chlorides, dissolved solids and lead,

and increased suspended solids, biological oxygen demand, and alkalinity. The reduction in chloride is due to decreased use of road salt. Lead in snow

comes from leaded gas and it has decreased significantly since being banned from passenger vehicle fuel. The increase in suspended solids and dis-

solved solids can be attributed to increased traffic in the urban area.

The Region disposes of snow in rented temporary sites or in regionally or municipally owned land. To reduce the contamination of land, the Regional Transportation Department is establishing permanent snow disposal sites for the urban area. These sites will use retaining ponds to remove the sediment and metals before melt water enters adjacent water supplies. ●

Constituents of Freshly Dumped Snow

Analysis mg/L	1989 Study ^a		1973 Study ^b
	Mean	Range	Mean
Chlorides	850	140-1500	2500
Suspended solids	2400	1800-3200	1600
Dissolved solids	1900	350-3200	3400
Biological oxygen demand	18	3-26	8.2
pH	7.9	7.5-8.5	6.1
Total lead	0.8	0.4-1.2	3.4

^a Johnston and Droste, 1989; ^b Richards, 1973.



PCBs

Polychlorobiphenyls (PCBs) are synthetic liquid chemical compounds that were used commercially for over 50 years. Their excellent fire resistant and insulating properties made PCBs ideal insulating and cooling fluids for industrial transformers,

capacitors, and hydraulic and heat-transfer systems. Unfortunately, these same properties make PCBs highly resistant to chemical and biochemical breakdown.

In the late 1960s, PCBs came to the public attention when their persistence

in the environment and their bio-accumulation in living organisms became known. Ingestion of PCBs can cause symptoms such as severe skin eruptions, increased eye discharge or systemic gastrointestinal symptoms with jaundice, edema and ab-

dominal pain. PCBs have caused cancer in laboratory animals and are suspected of being carcinogenic agents in humans.

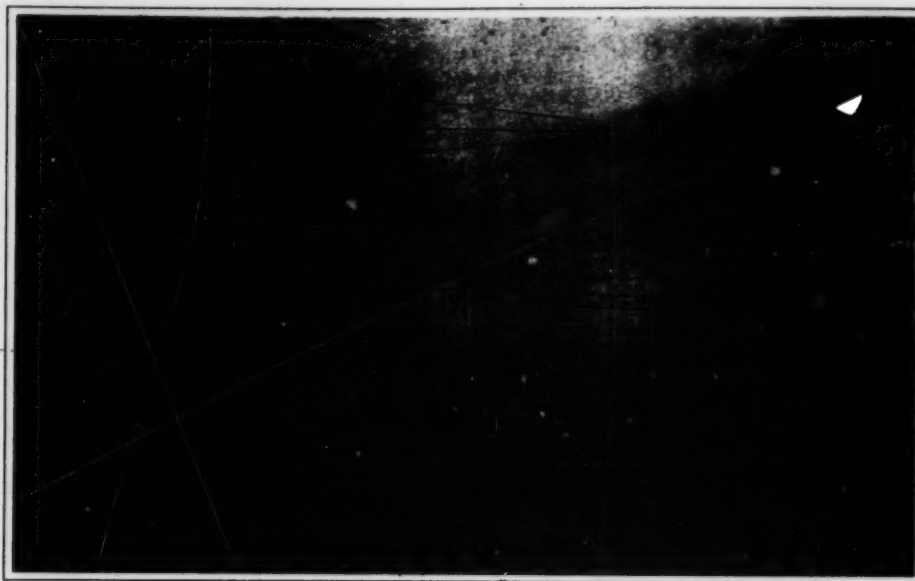
The manufacture of PCBs was banned in North America in 1977, and PCB-containing equipment is replaced as it



PCBS continued

wears out. Once PCB-containing equipment is decommissioned, the PCB waste must be dealt with. Commercial facilities for the destruction of high-concentration PCB liquid or solid wastes are not locally available. The first mobile PCB incinerator was operational in early 1991, and is being used elsewhere in Ontario. Two permanent incineration facilities in Ontario are in the planning stages in West Lincoln and Samia.

Until PCB disposal facilities are available, PCB wastes are stored. There are 34 PCB storage sites in Ottawa-Carleton. A list of PCB sites in Ottawa-



Carleton is maintained and monitored by the provincial Ministry of the Environment. Inspectors from

the Ottawa-Carleton Health Department also visit these sites regularly to ensure that they are

safely maintained. All PCB storage sites in Ottawa-Carleton are satisfactorily maintained. ●



Land Contamination

The extent of land contamination as a result of past land use is not well documented in the Region, although the City of Ottawa has completed a study on past industrial use, identifying sites of potential contamination. No other municipality has done a similar study.

Residues from present and defunct industry, effluent from leaky tanks, soil contamination from landfill sites and accidental spills of hazardous materials all contribute to land contamination. It is estimated by MOE that a high per-



centage of underground storage tanks used in Ottawa-Carleton leak or have leaked in the past.

Thousands of hazardous

spills are reported in Ontario each year. Half the spills involve oil or other fuels and 20 per cent involve chemicals. In Ottawa-Carleton the Re-

gional Emergency Measures Unit responded to 781 hazardous waste emergencies and 676 motor-vehicle accidents involving fuel spills in the first 10 months of 1990. The materials involved included inflammable liquids (74%), compressed or liquefied gas (12%), unknown waste products (8%), poisonous oxidizing substances (4%) and poisonous inflammable substances (2%). The Ontario Ministry of the Environment does not have a policy dealing with soil contamination and deals with each incident separately. ●



Wetlands

Before it was developed, Eastern Ontario was a rich network of wetlands. However much of the wetland area has been drained for residential and agricultural use in the last 100 years. Wetlands aren't just important to the wildlife and plants that depend on them. Humans, too, benefit from their presence because wetlands act as ground water recharge areas and natural water purification systems. Without wetlands, ground water quality is put into question.

The few surviving wetlands are under constant pressure from agriculture and urbanization. Wetlands within Regional urban areas are now extremely rare and exist only because they are protected. Those in the greenbelt and surrounding the three urban areas are threatened by urban expansion, both directly when they are filled or drained, and indirectly when their ground water sources are

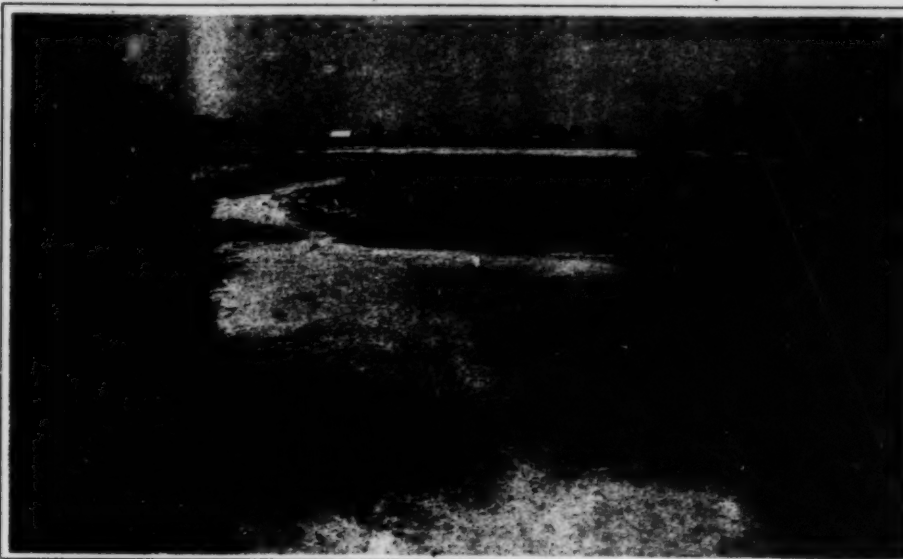
affected. As the population expands in the rural areas, the ground water is simultaneously stressed by human pollution and overuse.

The greatest loss in wetlands in recent years has been through drainage of agriculture land. Removal of water increases the fertility of the farmland, extends the growing season and increases the soil's bearing strength so

that larger equipment can be used.

The province currently has programs to protect wetlands classified as provincially or regionally significant (Classes I, II and III). Thirty-seven wetlands in Ottawa-Carleton have been classified as of December 1, 1990. Of these, 57 per cent are provincially significant, 19 per cent are regionally significant and 24 per cent are lo-

cally significant. Other wetlands in the Region remain to be classified. Priority is given to wetlands of suspected provincial or regional significance or locally significant wetlands under threat of development. Although locally significant wetlands may be important to ground hydrology, they do not qualify for provincial protection. Protection must be initiated at the Regional or Municipal level. ●



Pesticides

The most common uses of pesticides in the Region are in agriculture, landscaping and insect control in buildings. The pesticide 2-4-D has received considerable publicity in Ottawa-Carleton because it is commonly used to control weeds in parks and private lawns. When used prop-



erly, pesticides are a useful tool. If used improperly, they can be very dangerous. The Poison Information Centre of Eastern Ontario estimates that 3.5 per cent of calls each year concern pesticides.

The use of pesticides in agriculture has increased



Pesticides, continued

considerably since the early 1970s. Through research and education of farmers, the Ontario Ministry of Agriculture and Foods plans to decrease pesticide use by 50 per cent by 2002. The use of

pesticides in park and lawn maintenance programs has been discontinued by some municipalities.

Building pest-control companies are encouraged by the Ontario Ministry of

the Environment to practise integrated pest management and use alternatives to chemical pesticides whenever possible. There is no data available to the Health Department concerning the extent of

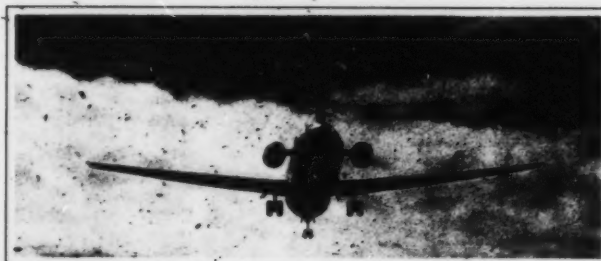
private pesticide use or the presence of pesticide contamination in local ground water supplies or farm produce. ●



Noise

Noise pollution is a symptom of urbanization and is an important factor in determining quality of life. The main sources of noise in the Region are traffic and aircraft. Noise levels have been reduced in the

Region by land-use planning, noise barriers and through noise by-laws. Most municipalities have some form of noise by-law, although some may be dated. ●



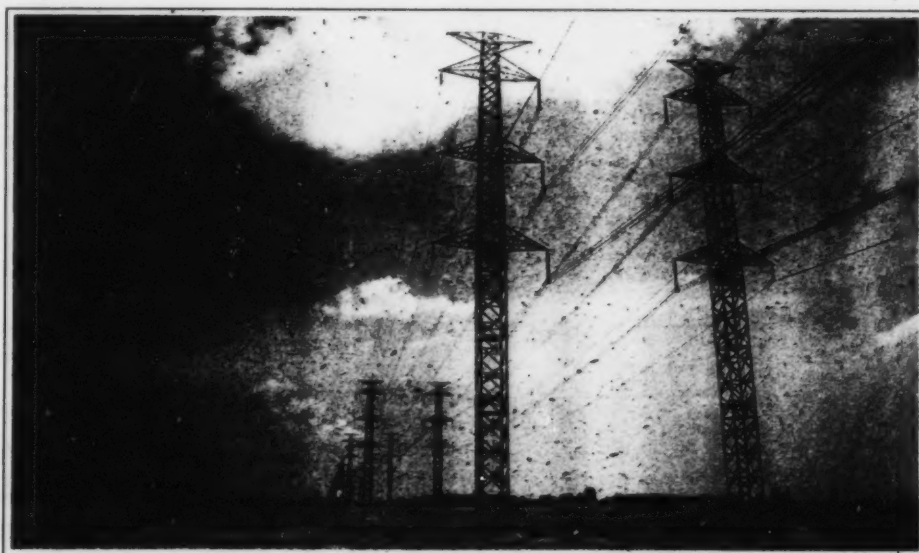
Electromagnetic Fields

To supply enough electricity to meet the Region's needs, the number of high-voltage transmission lines has increased. This concerns some residents, as some reports link the magnetic fields generated by electricity to cancer. Magnetic fields are also generated by household appliances and improper grounding of homes. Until the effects of magnetic fields are better understood, legislative standards for safe levels of exposure to magnetic fields will be debated. **An intensive worldwide research program has not proven that exposure to electromagnetic fields directly causes cancer. However**

research into apparent correlations is in progress and the Health Department continues to monitor this research.

Because research is inconclusive, residents should do what they can to reduce their own exposure to magnetic fields within the

home. Utilities should also do what they can to prevent further increases in public exposure to high voltage wires. ●



L'ÉTAT DU MILIEU

PERSPECTIVE SUR L'HYGIÈNE DU MILIEU



Ces vingt dernières années, les résidents et les administrations municipales d'Ottawa-Carleton ont atteint un nouveau degré de sensibilisation aux questions environnementales. L'écologie, c'est-à-dire la relation entre tous les éléments d'un milieu, y compris la géologie, le climat, la flore, les animaux et les êtres humains, a cessé d'être un enjeu marginal. Il s'agit d'une question brûlante. Il est très net que nos relations avec l'environnement exigent que nous soyons davantage sensibles aux interactions complexes entre ces éléments.

Le Service de la santé de la Municipalité régionale d'Ottawa-Carleton constitue un maillon puissant dans nos relations avec notre environnement. Voué à la promotion d'une santé optimale grâce au leadership, à l'innovation et au service, le Service de la santé oeuvre à la sauvegarde de notre qualité de vie à mesure que la population de la MROC croît. En outre, le gouvernement provincial exige de chacun des services de la santé de la province qu'il produise un rapport sur les risques environnementaux locaux au minimum tous les cinq ans, avec une mise à jour annuelle. Le Rapport sur l'état du milieu de 1991 constitue le premier de ces rapports élaborés par le Service de la santé de la MROC et nous aide à rem-



plir ce mandat.

Le Rapport sur l'état du milieu présente un instantané des manières dont les conditions actuelles influent sur la santé, et comporte un certain nombre de lignes directrices pour les mesures à prendre. Il répond aux préoccupations du public en matière d'environnement et expose en détail l'état actuel de nos connaissances au sujet d'un grand nombre des facteurs qui influent sur l'air, l'eau et les sols.

Dans chacun des cas, nous décrivons les dangers potentiels pour la santé, nous déterminons les questions qui pourraient être préoccupantes, et nous présentons des données pertinentes concernant le sujet. Les

constatations environnementales, par exemple, la teneur en plomb de l'eau domestique, font l'objet de comparaisons par rapport à la réglementation fédérale et provinciale. Les critères contenus dans ces règlements, souvent qualifiés de «lignes directrices» ou d'«objectifs» évoluent à mesure que nous en apprenons davantage sur les produits chimiques et les technologies que nous mettons en oeuvre chaque jour, et en ce qui concerne l'environnement proprement dit.

Il reste beaucoup à apprendre. Parfois les effets sur la santé d'un produit chimique ou d'une technologie en particulier sont inconnus. Dans d'autres cas, on ne connaît pas la quantité d'un produit chimique en particulier ou la prédominance d'une procé-

sure en particulier, ou on ne dispose pas de données spécifiques concernant Ottawa-Carleton. Par exemple, on reconnaît l'existence d'une préoccupation environnementale telle que celle du «syndrome des édifices à bureaux», mais nous ne disposons pas encore de la technologie qui permettrait de le définir ou d'en éliminer la cause. Néanmoins, **le fait de consigner ce que nous savons effectivement constitue une étape importante vers le changement.**

L'expérience d'Ottawa-Carleton a démontré que les résidents, les administrations municipales et les cantons peuvent collaborer et modifier notre environnement dans le bon sens. Des documents tels que le Rapport sur l'état du milieu de 1991 attestent de ces efforts et permettent d'orienter nos entreprises futures.

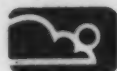
L'étape suivante consistera pour nous à fixer des priorités et à nous attaquer aux problèmes. Nous demandons au Comité de la santé de la MROC de nous orienter, et au Comité consultatif de l'hygiène du milieu (composé de représentants de la collectivité et des trois niveaux de gouvernement) ainsi qu'à d'autres membres de la collectivité de nous aider à mesure que nous progressons. ●

Dr S.J. Corber
Médecin-hygiéniste

Le Rapport sur l'état du milieu (en anglais seulement) ainsi que des copies supplémentaires des Points saillants du Rapport sur l'état du milieu sont disponibles au : Service de la santé d'Ottawa-Carleton, Communications
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Qualité de l'air à l'extérieur

La qualité de l'air extérieur dans la région est très bonne la plupart du temps. À l'occasion, il se produit des incidents où la qualité de l'air baisse, mais ce fait est rare et se produit en général uniquement en été, par temps chaud, sans vent. Comme il y a peu d'industries responsables de sources ponctuelles importantes de pollution de l'air, et étant donné qu'il y a suffisamment de ventilation naturelle, la plus grande partie de la pollution de l'air dans la région se disperse avant d'affecter la qualité de l'air ambiant. C'est la combinaison des conditions climatiques, de l'intensité des émissions et de l'emplacement des sources de pollution de l'air qui détermine la qualité de l'air ambiant un jour donné. Nous subissons également les effets des sources de pollution à l'extérieur de la région, qui contribuent à la pollution par l'ozone et aux mauvaises odeurs.

Une «mauvaise» qualité de l'air provient la plupart du temps d'un niveau élevé d'ozone. Les particules en suspension telles que les poussières, le pollen et les gaz d'échappement diesel



tiennent le deuxième rang parmi les causes les plus communes de problèmes de qualité de l'air. Les niveaux ambiants de monoxyde de carbone, d'anhydride sulfureux et de plomb en suspension dans l'air extérieur diminuent dans la région depuis dix ans.

La surveillance de la qualité de l'air d'Ottawa-Carleton se fait à la station de surveillance de la pollution atmosphérique de MacDonald Gardens sur une base continue. La qualité de l'air à Ottawa-Carleton correspond au niveau supérieur de l'index de

la qualité de l'air 89,6 % du temps.

Les centres urbains de la région sont également affectés par les sources locales de pollution de l'air. **Jusqu'à 75 % de la pollution de l'air dans les centres urbains est attribuable aux véhicules automobiles.** Les gaz d'échappement des voitures, des autobus et des camions contiennent à la fois des polluants primaires comme le monoxyde de carbone, des hydrocarbures, des oxydes d'azote et du dioxyde de carbone, ainsi que des polluants secondaires tels que l'ozone, oxy-

dant photochimique. Les autobus et les voitures à moteur diesel émettent de 50 à 80 fois plus de particules que les moteurs à essence.

Grâce au resserrement des normes pour les automobiles et à la réduction de la teneur en plomb de l'essence, les taux d'émission de pollution par les automobiles ont diminué de plus de 40 % ces dix dernières années. Par contre, pendant la même période, la circulation a augmenté de 12 % sur les routes d'Ottawa-Carleton et de l'Outaouais. Pour atteindre des niveaux de pollution de l'air encore plus bas, il faut réduire le nombre des voitures qui circulent sur les routes et rendre encore plus sévères les normes de pollution de l'air pour tous les véhicules.

Parmi les autres sources de pollution urbaine, citons les systèmes de chauffage domestique, les émissions commerciales industrielles, ainsi que les sources naturelles. ●

Station de surveillance de la pollution atmosphérique de MacDonald Gardens

Indication de l'IQA	Nombre d'heures en 1989	Pourcentage du temps
Très bon (0-15)	7829	89,6 %
Bon (16-31)	876	10,0 %
Moyen (32-49)	36	0,4 %
Mauvais (50-99)	0	0,0 %
Très mauvais (100 +)	0	0,0 %

L'IQA représente l'index de la qualité de l'air.



Qualité de l'air à l'intérieur

Avant l'apparition d'édifices à bureaux étanches et des maisons hermétiques, on ne considérait pas la qualité de l'air à l'intérieur comme un problème. Désormais, le milieu intérieur peut avoir une portée considérable sur votre santé. Les travailleurs de bureau et les personnes à la maison peuvent eux aussi souffrir d'un séjour prolongé dans un milieu contaminé.

Ce que l'on sait de la manière dont la pollution de l'air à l'intérieur affecte la santé et de l'ampleur du problème dans Ottawa-Carleton reste lacunaire. Nous savons cependant que l'air à l'intérieur peut être pollué par des substances telles que la fumée directe secondaire, le radon, les particules d'amiante et l'isolation à l'urée-formol. Dans un bâti-

ment hermétique, il y a concentration d'air usé et de produits chimiques en suspension dans l'air, ce qui nuit à la santé des humains. Ce phénomène s'est traduit par l'apparition de l'expression «syndrome des édifices à bureaux».

Dans l'air intérieur, on retrouve des polluants de l'air extérieur, de même que des polluants en provenance d'activités intérieures. Parmi les sources intérieures, mentionnons le monoxyde et le dioxyde de carbone provenant du chauffage et des appareils de cuisson, le radon provenant des dépôts d'uranium dans le sol et dans les matériaux de construction, des composés organiques volatiles provenant des matériaux de construction et des accessoires d'ameublement,

des particules en provenance de la fumée de cigarettes et de l'amiante, des oxydes d'azote des fourneaux à gaz et des micro-organismes attribuables aux humains, aux animaux de compagnie et aux humidificateurs. Parmi les polluants extérieurs les plus communs, mentionnons l'ozone, les particules en suspension telles que le pollen et la poussière, le monoxyde de carbone, l'anhydride sulfureux et le plomb en suspension.

La sensibilité individuelle aux polluants de l'air varie fortement d'une personne à l'autre. À mesure que la quantité et la diversité des produits chimiques que notre société utilise augmentent, et du fait que les efforts d'économie d'énergie se traduisent par des bâtiments où l'arri-

vé de l'air naturel diminue de plus en plus, notre exposition à la pollution augmente également. Un plus grand nombre de personnes se déclarent actuellement sensibles et allergiques à ces polluants.

La ventilation, l'épuration de l'air et l'enlèvement ou l'isolation des sources de pollution constituent les trois grands moyens de garantir une qualité adéquate de l'air à l'intérieur. Toutefois, étant donné que chaque milieu intérieur est différent des autres, il est difficile de concevoir une solution unique pour tous les édifices à bureaux. La réduction des effets néfastes de la pollution intérieure nécessite que l'on connaisse mieux ses composantes et ses effets, puis que l'on mette au point des solutions spécifiques. ●



Qualité de l'eau potable

Assurer par la surveillance le ravitaillement en eau potable propre et sûre constitue une responsabilité fondamentale de santé publique. La rivière des Outaouais fournit à notre région une source relativement propre d'eau potable. Cela provient de sa taille et de son débit importants et de l'absence d'industries lourdes et de gros aménagements dans le bassin de drainage en amont d'Ottawa-Carleton. **Le ravitaillement en eau de la MROC satisfait à toutes les normes de sécurité fédérales et provinciales applicables à l'eau potable;** sa sécurité microbiologique est assurée par désinfection à deux usines de traitement de l'eau. La désinfection dans les usines de la MROC débute par la chloration de l'eau brute et se termine par

une dose supplémentaire de chlore avant qu'elle ne pénètre dans le système de distribution. **Le dosage de la chloration complémentaire augmente au fil des ans propor-**

tionnellement à l'expansion du système de distribution. Cela élimine la réapparition d'organismes aux extrémités du réseau.

La qualité chimique de l'eau

se mesure en parties par milliard. On trouve à l'occasion des teneurs négligeables en pesticides et en produits organiques tels que des phtalates dans l'eau potable, mais à des niveaux bien inférieurs aux normes ontariennes et canadiennes pour l'eau potable. Les trihalométhanes (THM) sont des sous-produits du processus de désinfection. **On retrouve de plus forts niveaux de THM dans notre eau que dans d'autres sources d'eau potable d'Ontario, mais les lignes directrices sont néanmoins respectées.** Ces niveaux élevés sont vraisemblablement le résultat d'une forte quantité d'impuretés organiques dans l'eau brute et le niveau de plus en plus élevé des résidus de la chloration complémentaire que l'on retrouve à la





Qualité de l'eau potable (suite)

MROC.

La planification d'une usine de traitement de l'eau progresse; elle aura pour vocation l'essai d'autres techniques de traitement de l'eau, et s'attachera particulièrement à ramener le niveau des trihalométhanes de la région à celui d'autres réseaux d'eau municipaux.

Le plomb et l'aluminium sont deux autres contaminants constituant des sous-produits du traitement et de la distribution. Ils satisfont aux lignes directrices sur l'eau potable, mais sont

préoccupants en raison de leur incidence potentielle sur la santé humaine. Les niveaux de radiation sont bien inférieurs aux objectifs.

Les résidents ruraux sont tributaires des eaux souterraines pour le ravitaillement en eau potable, soit à partir de puits de surface ou de puits plus profonds. **Dans la région, les puits de surface sont sujets à la contamination bactériologique du fait de la proximité de systèmes septiques en mauvais état. L'accroissement du développement rural dans les**

petites localités augmente également la pression sur les approvisionnements limités en eau. Plusieurs localités rurales présentent un nombre important de puits contaminés par les bactéries. Les nitrates sont également préoccupants dans certaines régions où les engrais et (ou) les eaux usées ont contaminé le réservoir aquifère. Grâce à des dispositifs de traitement des puits, à des puits collectifs et à des puits plus profonds, on a pu corriger la plupart des problèmes connus.

En général, les puits forés dans la MROC ne souffrent pas de contamination bactérienne, mais certains contiennent des niveaux élevés de produits chimiques esthétiquement gênants. Des minéraux comme le fer, les sels et le sulfure donnent à l'eau de certains puits de la région des goûts et des odeurs désagréables. Les niveaux élevés de calcium et de magnésium sont à l'origine de l'eau «dure», qui obscurcit les conduites et diminue l'efficacité du savon et des détersifs. ●



Eau récréative

La rivière des Outaouais et la rivière Rideau servent toutes deux énormément aux loisirs. Ces dix dernières années, la pollution urbaine a causé la fermeture des plages. La qualité de l'eau se détériore en général au cours du passage des rivières par les centres urbains. Les plages à l'extérieur de la ville ne souffrent pas de contamination bactérienne et restent ouvertes au public tout au long de la saison de la baignade.

Plusieurs groupes surveillent la qualité de l'eau et enquêtent sur tous les incidents de pollution. Cela a permis de réduire la pollution en provenance de sources connues et de conserver la qualité de l'eau des plages à un niveau relativement constant au fil des ans malgré la pression de la pollution urbaine. La technologie permettant de prévoir et d'évaluer la qualité de l'eau récréative s'améliore constamment, ce qui permet au Service de la santé de réduire l'exposition des ré-

sidents à la pollution de l'eau. Les niveaux croissants de bactéries, de matières en suspension et de phosphates dans la rivière Rideau ont amené les résidents et les organismes intéressés à augmenter leurs efforts pour ré-

soudre le problème de la détérioration de la qualité de l'eau. Le fait que la rivière Rideau soit plus petite l'expose davantage à la pollution. La contamination au mercure du poisson de sport dans ce cours d'eau s'est tra-

duite par des lignes directrices pour la consommation.

Dans les zones rurales, la pollution des rivières provient de l'insuffisance des usines rurales de traitement des eaux usées, de l'agriculture et de l'industrie forestière. Des programmes sont en place visant la réduction de toutes ces sources.

Dans les zones urbaines, le traitement inadéquat des eaux usées, le débordement dans le système des égouts pluviaux et le déversement de produits chimiques dans le réseau des égouts par l'industrie (en particulier par celle de l'électronique) sont préoccupants. Parmi les initiatives de contrôle de la MROC de la pollution dans la zone urbaine, mentionnons une usine améliorée et plus grande de traitement des déchets, des normes plus élevées pour les collecteurs d'eaux pluviales dans les nouvelles zones d'habitation, et le remplacement des anciens réseaux unitaires d'eaux pluviales et d'eaux usées. ●





Espaces verts

Ottawa-Carleton dispose de grandes étendues de parcs, de zones naturelles et d'espaces ouverts de propriété publique. Ces espaces verts contribuent à la qualité de vie dont nous jouissons et constituent un facteur important tant pour la santé physique que pour le bien-être affectif. La plupart des résidents habitent à moins d'une demi-heure de la nature où l'on peut se promener sur des pistes de plein air, observer les oiseaux ou jouir d'un magnifique paysage.

La planification des espaces verts par le gouvernement fédéral a débuté à la fin des années 1890 lors de la création



de l'organisme précurseur de la Commission de la capitale nationale. La région a la chance de bénéficier de cette planification antérieure ainsi

que de l'entretien continu des parcs existants. La province entretient deux parcs provinciaux et six zones de conservation dans la région. Les

municipalités fournissent également très activement des parcs et des installations de loisirs aux résidents. ●



Gestion des déchets solides

La gestion convenable de tous les types de déchets solides est importante pour la sauvegarde de la santé publique. Une gestion défectueuse des déchets peut amener une contamination biologique et chimique du sol, de l'eau ou de l'air.

Nos attitudes envers le traitement des déchets se sont profondément modifiées ces vingt dernières années, en particulier en ce qui concerne les effets sur l'environnement. C'est ainsi que le gestionnaire des déchets solides doit aujourd'hui se débattre avec les erreurs du passé tout en faisant face aux préoccupations actuelles et aux besoins futurs.

Les déchets solides se décomposent chimiquement et biologiquement et deviennent des produits solides, liquides et gazeux. Parmi les facteurs qui influent sur la décomposition, mentionnons la composition des déchets; leurs pro-

priétés physiques, chimiques et biologiques; l'oxygène; le degré d'humidité; la température; la population microbienne.

Les trois grandes préoccupations que comportent les décharges publiques sont les suivantes :

a) Contamination par le percolat des eaux de surface, de fond et des puits - habituellement un problème rural.

b) Production de méthane - généralement un problème dans les zones aménagées.

c) Contamination du sol par des déchets dangereux - devient un problème lorsque le terrain sert à une autre fin ou que cela affecte le ravitaillement en eau des nappes souterraines.

Le percolat se produit lorsque l'eau de surface s'infiltre dans la décharge, extrayant les micro-organismes et les

produits chimiques hydrosolubles des déchets solides. Le percolat peut également contenir des produits chimiques toxiques organiques et inorganiques que l'on a jetés. Si le terrain sur lequel repose la décharge est perméable, le percolat peut pénétrer la nappe d'eau et la contaminer.

Lorsque l'oxygène d'une décharge est épuisé, il y a production de méthane et de dioxyde de carbone par décomposition microbienne des déchets. Le taux de production du méthane dépend du type de déchet, de sa température et de son degré d'humidité. La production de méthane peut se poursuivre jusqu'à un siècle après la fermeture de la décharge. Le méthane est plus léger que l'air, et lorsque les conditions le permettent, il s'échappe du site d'enfouissement. Dans certains milieux géologiques où les déchets sont retenus par des matériaux plus perméables, le méthane peut





Gestion des déchets solides (suite)

s'échapper plus facilement. S'il se répand, par exemple, dans un espace fermé en-dessous d'un bâtiment, il y a une certaine possibilité d'explosion.

Une bonne conception du site d'enfouissement peut éviter les problèmes que comportent le percolat et le gaz méthane.

Le ministère ontarien de l'Environnement a la responsabilité d'évaluer les possibilités de danger pour l'environnement et la santé des décharges inactives et actives. La région a connaissance de 79 décharges inactives, mais comme les dossiers historiques des anciens sites d'enfouissement sont lacunaires, il est impossible de dire s'il y en a davantage. On a évalué le risque de production de méthane de 44 sites à l'intérieur de la ville d'Ottawa. Il n'y a eu aucune évaluation environnementale importante des sites d'enfouissement ruraux.

Il existe actuellement cinq décharges actives, dont quatre sont constamment surveillées. À trois de ces endroits - Laidlaw, Huneault et chemin Trail - des mesures correctrices se sont occupées des percolats ou du méthane qui pourraient s'échapper du site. Le site d'Almonte ne nécessite aucune mesure correctrice pour l'instant. Le site de Springhill a fait l'objet d'une évaluation hydrogéologique préliminaire, et un rapport doit paraître en 1991.

Il est essentiel de surveiller ces décharges avec vigilance pour s'assurer qu'il n'y a aucun effet néfaste pour la santé. Fait encore plus important, il faut réduire la quantité des déchets envoyés aux décharges. C'est là une responsabilité de cha-



que résident, municipalité, canton et entreprise.

Au moment où les décharges actuelles se rapprochent de leur capacité, la gestion des déchets solides constitue une préoccupation croissante. Afin de se préparer à l'avenir, le plan directeur de gestion des déchets de la MROC est actuellement à ses débuts. Une partie importante du plan directeur est l'élaboration de programmes de réacheminement des déchets. Le gouvernement de l'Onta-

rio a fixé 1993 comme objectif pour le réacheminement de 25 % de tous les déchets des décharges, et l'atteinte de 50 % d'ici l'an 2000. Les instances régionales et municipales collaborent à l'atteinte de ce but. Parmi les programmes, mentionnons les installations pour les déchets dangereux, les programmes de compostage et de recyclage. La région a déjà entrepris de nombreuses initiatives, dont la Semaine du contenant unique, le recy-

clage des annuaires téléphoniques, la publication d'un répertoire des entreprises de recyclage de la région, et le parrainage de plusieurs jours de nettoyage environnemental des ordures ménagères.

Un site permanent pour l'évacuation des produits dangereux devrait être à la disposition du public d'ici la fin de 1991. En 1987, une enquête aux États-Unis sur les produits dangereux dans les ménages a découvert que la plupart des ménages entreposaient des produits de peinture (21,1 %), des insecticides (13,9 %), des produits de nettoyage (10,5 %) et des produits automobiles (10 %). Cela semble également s'appliquer typiquement à tout ménage d'Ottawa-Carleton. Parmi les dangers que comportent ces produits, mentionnons l'inflammabilité, la combustibilité, l'irritation de la peau et des yeux, et les conséquences néfastes ou mortelles si l'on avale le produit.

Les municipalités d'Ottawa-Carleton participent également activement au programme de recyclage ainsi que permet de le voir le tableau. ●

Programmes municipaux de recyclage

Municipalité	Programmes de boîtes bleues	Articles recueillis avec le programme de boîtes bleues	Autres programmes de recyclage
Cumberland	sept 1988	1,2,3,4,5	Composteurs, arbres de Noël
Gloucester	juin 1987	1,2,3,5	Composteurs, arbres de Noël
Goulbourn	avril 1990	1,2,3,5	Composteurs
Kanata	juin 1988	1,2,3,5	Dépôt, composteurs, arbres de Noël, feuilles, vêtements usagés
Nepaan	juin 1987	1,2,3,4	Composteurs, sensibilisation, arbres de Noël
Osgoode	sept 1989	1,2,3,5	Aucun autre programme
Ottawa	juin 1987	1,2,3,4	Composteurs, arbres de Noël, feuilles, vêtements usagés
Rideau	****	****	Dépôt
Rockcliffe Park	janv 1990	1,2,3,5	Feuilles
Vanier	mai 1991	1,2,3,5	Composteurs
West Carleton	****	****	Dépôt, composteurs, arbres de Noël, feuilles, vêtements usagés

1 journaux ; 2 bouteilles de verre ; 3 canettes et boîtes de conserve ; 4 huile à moteur ; 5 bouteilles de plastique transparent



Pneus

Depuis l'incendie des pneus de Hagersville, l'évacuation de pneus est devenue un enjeu important de gestion des déchets. En vertu du Code des incendies de l'Ontario, les pneus ne peuvent être empilés que jusqu'à concurrence de 5000 - pile qui représente environ 10 mètres sur 10 mètres sur 3 mètres.

Au 1^{er} octobre 1990, les sites qui entreposaient plus de 5000 pneus devaient faire une demande au ministère de l'Environnement pour obtenir un permis de site d'évacuation des déchets.

À l'heure actuelle, aucun site d'enfouissement de la MROC sauf celui du chemin Trail n'accepte de pneus.

Quatre sites de pneus à Ottawa-Carleton sont certifiés. À ces emplacements, on enterre les pneus ou on fait en sorte de réduire les dangers d'incendie. **Le ministère de l'Environnement a inspecté ces sites et les a trouvés satisfaisants.** À deux autres emplacements qui ne détiennent pas encore de certificat,

la province fournit des gardes de sécurité jusqu'à ce que l'on ait convenablement assuré la retenue des pneus. Les Services environnementaux de la MROC sont disposés à s'occuper de tous les stocks de la région dès qu'on aura annoncé une politique provinciale d'évacuation. ●



Neige

L'évacuation des neiges usées est susceptible de contaminer le sol et la superficie ainsi que les nappes souterraines voisines. **Les principaux contaminants de l'environnement dans la neige urbaine sont les chlorures, le sodium, le calcium, le plomb et les particules en suspension.** Les contaminants proviennent principalement des produits de déglacage chimique et des gaz d'échappement des automobiles. On trouvera au tableau une comparaison entre la composition de la neige dans une étude de 1989 et celle d'une étude de 1973. Il s'est produit une diminution importante des chlo-

rures, des matières dissoutes et du plomb, et un accroissement des particules en suspension, de la demande biologique en oxygène et de l'alcalinité. La réduction des chlorures est due à la diminution

du recours aux sels sur les routes. Le plomb dans la neige usée provient de l'essence avec plomb et a sensiblement diminué depuis qu'on l'a éliminé du carburant des véhicules de tourisme. L'augmen-

tation des particules en suspension et des matières dissoutes peut s'attribuer à l'augmentation de la circulation dans le secteur urbain.

La MROC évacue la neige vers des sites temporaires loués ou l'entrepose sur ses propres terres ou celles appartenant aux municipalités. Afin de réduire la contamination des sols, le Service des transports de la MROC est en train d'établir des sites permanents d'évacuation de la neige pour la zone urbaine. Dans ces sites, on aura recours à des bassins-réservoirs pour éliminer les sédiments et les métaux avant que l'eau de fonte ne pénétre dans les sources adjacentes d'eau. ●

Composition de la neige entreposée

Analyse mg/L	Étude de 1989 ^a		Étude de 1973 ^b
	Moyenne	Étendue des valeurs	Moyenne
Chlorures	850	140-1500	2500
Particules en suspension	2400	1800-3200	1600
Matières dissoutes	1900	350-3200	3400
Demande biologique en oxygène	18	3-26	8,2
pH	7,9	7,5-8,5	6,1
Total de plomb	0,8	0,4-1,2	3,4

^a Johnston et Droste, 1989; ^b Richards, 1973.



BPC

Les biphényles polychlorés (BPC) sont des composés chimiques synthétiques liquides que l'on utilisait dans le commerce depuis plus de 50 ans. Leurs excellentes propriétés ignifuges et isolantes en faisaient un liquide idéal d'isolation et de refroidissement pour les transformateurs industriels, les condensateurs et les systèmes hydrauliques

et de transfert de la chaleur. Malheureusement, ces mêmes propriétés rendaient les BPC hautement résistants à la décomposition chimique et biochimique.

Vers la fin des années 1960, l'attention du public s'est portée sur les BPC lorsqu'on a appris leur persistance dans l'environnement et leur bioaccumulation dans les êtres

vivants. L'ingestion de BPC peut provoquer des symptômes tels que de graves éruptions cutanées, un accroissement de l'écoulement des yeux ou des symptômes gastro-intestinaux systémiques comportant jaunisse, œdème et douleurs abdominales. Les BPC ont provoqué le cancer chez des animaux de laboratoire et on les soup-

çonne d'être carcinogènes pour les humains.

La fabrication de BPC a été interdite en Amérique du Nord en 1977, et l'équipement contenant des BPC est remplacé au fur et à mesure de son usure. Une fois que l'équipement contenant des BPC sera hors service, il faut s'occuper des déchets de BPC. On ne dispose pas



BPC (suite)

localement d'installations commerciales pour la destruction de déchets liquides ou solides à forte concentration de BPC. Le premier incinérateur de BPC était opérationnel dès le début de 1991, et il sert dans une autre partie de l'Ontario. Deux installations permanentes d'incinération en Ontario en sont à l'étape de planification à West Lincoln et à Samia.

En attendant de disposer



d'installations de destruction de BPC, ces déchets sont

stockés. Il existe 34 sites d'entreposage de BPC à

Ottawa-Carleton. Le ministère de l'Environnement tient une liste des sites de BPC d'Ottawa-Carleton et les surveille. Les inspecteurs du Service de la santé d'Ottawa-Carleton visitent également ces centres périodiquement pour s'assurer qu'ils sont entretenus de manière sûre. Tous les sites d'entreposage de BPC à Ottawa-Carleton sont entretenus de façon satisfaisante. ●



Contamination des sols

L'ampleur de la contamination des sols provient de l'utilisation passée des sols et n'est pas bien connue sur le territoire de la MROC, bien que la ville d'Ottawa ait mené à bien une étude sur l'utilisation industrielle

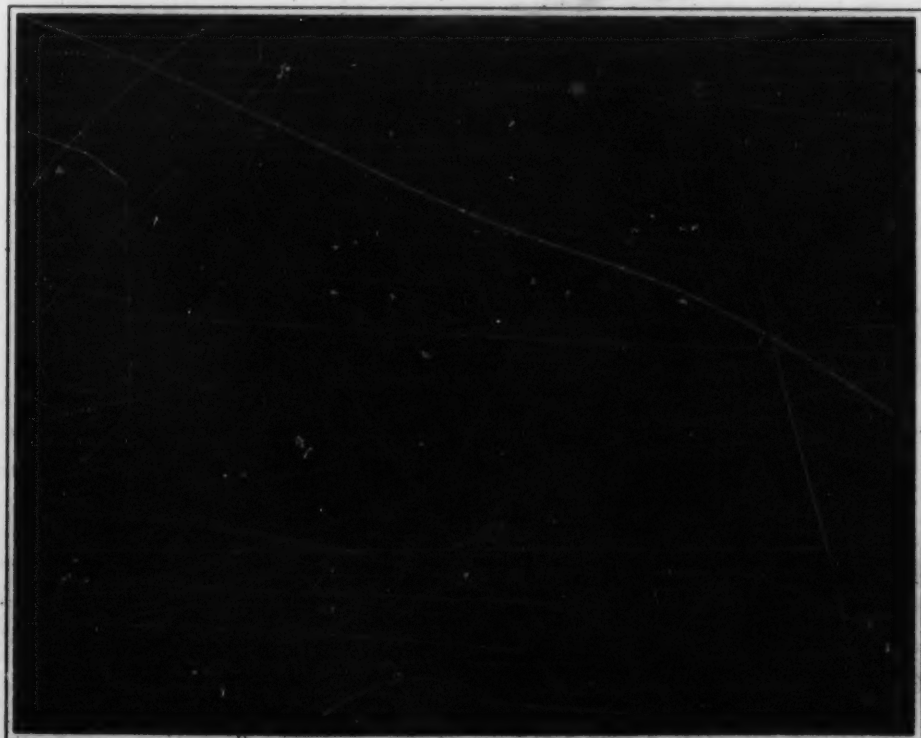
passée, en déterminant des sites de contamination potentielle. Aucune autre municipalité n'a procédé à une étude analogue.

Les résidus de l'industrie actuelle et disparue, les effluents des fuites de réservoirs, la contamination des

sols des décharges et le déversement accidentel de matières dangereuses sont tous des facteurs contributifs à la contamination des sols. Le ministère de l'Environnement estime qu'un haut

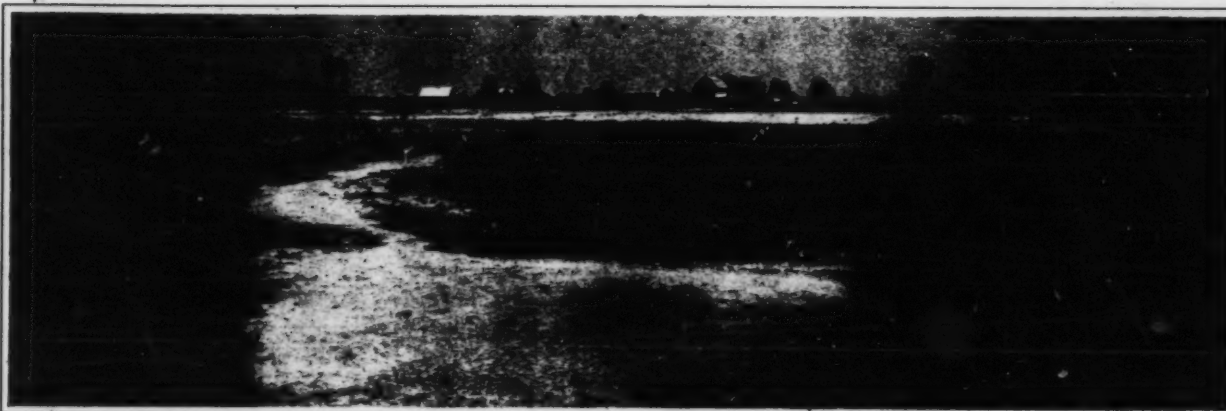
pourcentage des réservoirs souterrains utilisés à Ottawa-Carleton ont des fuites ou en ont eu.

On signale des milliers de déversements dangereux en Ontario chaque année. La moitié d'entre eux comportent du mazout ou d'autres carburants et combustibles, et 20 % portent sur des produits chimiques. À Ottawa-Carleton, la Section des mesures d'urgence s'est occupée de 781 cas d'urgence en matière de déchets dangereux et de 676 accidents automobiles comportant des déversements de carburant au cours des 10 premiers mois de 1990. Parmi les matières en cause, mentionnons des liquides inflammables (74 %), des gaz comprimés ou liquéfiés (12 %), des déchets de nature inconnue (8 %), des substances nocives comburantes (4 %) et des substances nocives inflammables (2 %). Le ministère ontarien de l'Environnement n'a aucune politique traitant de la contamination des sols et s'occupe de chaque incident individuellement. ●





Terres marécageuses



Avant son aménagement, l'Est de l'Ontario constituait un riche réseau de terres humides. Mais une grande partie des zones de terres humides a été drainée en vue d'une utilisation résidentielle et agricole ces cent dernières années. Les terres marécageuses n'ont pas seulement une importance pour la faune et pour la flore qui en dépendent. L'être humain lui aussi bénéficie de leur présence, parce que les terres humides font fonction de zones de réapprovisionnement en eau et de système naturel de purification de l'eau. Sans les terres humides, la qualité des nappes souterraines est remise en question.

Les rares terres humides qui subsistent subissent des pressions constantes de la part de l'agriculture et de l'urbanisation. Les terres marécageuses à l'intérieur des zones urbaines de la MROC sont désormais extrêmement rares et n'existent que parce qu'on les protège. Celles de la ceinture verte et avoisinant les trois zones urbaines sont menacées par l'expansion urbaine, aussi bien directement lorsqu'on les comble ou qu'on les draine, qu'indirectement lorsque leurs sources souterraines sont mises en cause. À mesure que la population s'étend dans les secteurs ruraux, les nappes souterraines subissent en même

temps les tensions de la pollution et de la surutilisation par les humains.

La plus grande perte de terres humides ces dernières années a été causée par le drainage des terres agricoles. Le fait d'éliminer l'eau augmente la fertilité des terres agricoles, prolonge la saison de culture et augmente la capacité du sol à supporter de l'équipement plus gros.

Actuellement, la province dispose de programmes de protection des terres humides classées comme ayant une signification provinciale ou régionale (de classes I, II et-III). Trente-sept terres marécageuses dans Ottawa-Carleton

étaient classées au 1^{er} décembre 1990. Parmi elles, 57 % ont une importance provinciale, 19 % ont une importance régionale, et 24 % ont une importance locale. D'autres terres humides de la région restent à classer. On donne la priorité aux terres humides dont on pense qu'elles ont une importance provinciale ou régionale, où aux terres humides à importance locale menacées d'aménagement. Bien que les terres humides à importance locale puissent être importantes pour l'hydrologie souterraine, elles ne sont pas admissibles à une protection provinciale. La protection doit venir de la MROC ou du niveau municipal. ●



Pesticides

L'utilisation la plus commune de pesticides sur le territoire de la MROC porte sur l'agriculture, l'aménagement paysager et la lutte contre les insectes dans les bâtiments. Le pesticide 2-4-D a fait l'objet d'une publicité considérable à Ottawa-Carleton parce qu'on l'utilise couramment pour détruire les mauvaises herbes dans les parcs et sur les pelouses privées. Lors-

qu'on les utilise convenablement, les pesticides constituent un outil utile. Mal utilisés, ils peuvent être très dangereux. Le Centre de renseignements antipoison de l'Est de l'Ontario estime que 3,5 % des appels de l'année concernent des pesticides.

Le recours aux pesticides en agriculture a considérablement augmenté depuis le début des années 1970. Grâce à





Pesticides (suite)

la recherche et à l'éducation des agriculteurs, le ministère ontarien de l'Agriculture et de l'Alimentation prévoit diminuer l'utilisation des pesticides de 50 % d'ici l'an 2002. L'utilisation de pesticides dans les programmes

d'entretien des parcs et des pelouses a été abandonnée par certaines municipalités.

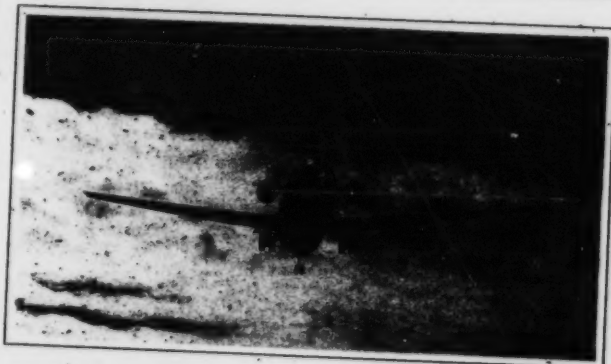
Le ministère ontarien de l'Environnement encourage les entreprises de déparasitage de bâtiments à mettre en oeuvre une gestion intégrée des

parasites et à utiliser dans toute la mesure du possible des produits de remplacement des pesticides chimiques. Le Service de la santé ne dispose d'aucune donnée concernant l'ampleur de l'utilisation de pesticides par les

particuliers ou la présence de contamination par les pesticides dans les nappes souterraines d'eau ou dans les produits agricoles. ●



Bruit



La pollution par le bruit est un symptôme de l'urbanisation et constitue un facteur important pour déterminer la qualité de vie. Les principales sources de bruit dans la région sont la circulation et les aéronefs. Les niveaux de bruit ont été réduits dans la région par la planification de l'utilisation des terres, des ouvrages antibruit et grâce à

des règlements antibruit. La plupart des municipalités disposent d'une forme ou d'une autre de règlements antibruit, bien que certains soient sans doute dépassés. ●



Champs électromagnétiques

Pour fournir suffisamment d'électricité pour les besoins de la région, on a augmenté le nombre de lignes de distribution haute tension. Cela préoccupe certains résidents, du fait que certains rapports relient les champs magnétiques produits par l'électricité au cancer. Il y a également production de champs magnétiques par les appareils électroménagers et une mise à la terre inadéquate des maisons. Jusqu'à ce que l'on comprenne mieux les effets des champs magnétiques, les normes législatives concernant les niveaux acceptables d'exposition aux champs magnétiques feront l'objet de débats. Un programme inten-

sif de recherche dans le monde entier n'a pas établi que l'exposition aux champs magnétiques cause directement le cancer. Des recherches concernant les corrélations apparentes se poursuivent toutefois, et le Service de la santé continue de les surveiller.

Étant donné que la recherche n'est pas concluante, les résidents doivent faire tout leur possible pour réduire leur propre exposition aux champs magnétiques à leur domicile. Les services publics doivent également faire tout leur possible pour prévenir tout accroissement supplémentaire d'exposition du public aux lignes de haute tension. ●





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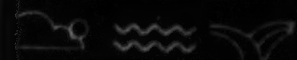


OTTAWA-CARLETON HEALTH DEPARTMENT
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and service.

ENVIRONMENTAL HEALTH PERSPECTIVE • STATE OF THE ENVIRONMENT REPORT • AN ENVIRONMENTAL HEALTH PERSPECTIVE



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STATE OF THE ENVIRONMENT REPORT

An Environmental Health Perspective

**Ottawa-Carleton Health Department
Environmental Health Directorate**

August 1991

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Regional Municipality of Ottawa-Carleton

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Ottawa-Carleton Health Department
495 Richmond Road
Ottawa, Ontario
K2A 4A4
Telephone: (613) 722-2328
Fax: (613) 724-4191

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by contacting the above address.

Les points saillants de ce rapport sont disponible en français
et en anglais en communiquant avec l'adresse ci-dessus.

FOREWORD

The Provincial Public Health Mandatory Healthy Programs and Services Guidelines require that each Health Department in the province produce a report on local environmental risk areas at least once every five years, with updates provided annually. The reports should be produced in accordance with the information obtained from the regional and district offices of the Ministry of the Environment, the Ministry of Labour and other agencies. This is the first such report produced by the Ottawa-Carleton Health Department. An accompanying document, the Ottawa-Carleton Health Status Report, has also been produced in 1991.

The mission of the Ottawa-Carleton Health Department is to promote optimal health in the community. Individual's health depends, not only on their biology and lifestyle, but on the environment and community in which they live. This report is an inventory of factors in the air, water and land of Ottawa-Carleton that might have an effect on human health. The key issues of particular note in Ottawa-Carleton are identified.

The reduction of any environmental health risk may involve several different players - government, policy makers, businesses, institutions or agencies, and members of the public. This report has several objectives:

- It provides an inventory of environmental conditions that may present a health threat in Ottawa-Carleton.
- It allows the Health Department to identify priorities for its own activities in this field.
- It provides a baseline report card against which we can measure our progress in future years.

Much of the work in this report was produced by Martha Robinson, Public Health Inspector, and Lorna Brownlee, Environmental Health Analyst. It was coordinated by the Environmental Health Directorate, Al Raven, Director.

The Health Department appreciates the data and advice it received from various regional sources:

FEDERAL GOVERNMENT: Canada Mortgage and Housing Corporation, Environment Canada, Health & Welfare Canada, Canadian Council of Ministers of the Environment, National Capital Commission and Statistics Canada.

PROVINCIAL GOVERNMENT: Access Ontario, Rideau Valley Conservation Authority, Mississippi Valley Conservation Authority, Ministry of the Environment, Ministry of Health, Ministry of Labour, Ontario Waste Management Corporation, Ministry of Natural Resources, Ministry of Agriculture and Food, Ministry of Transport, Ministry of Consumer and Corporate Affairs.

REGIONAL GOVERNMENT: Environmental Services Department, Department of Transportation, O.C. Transpo, Planning Department, Health Department, Environmental Health Advisory Committee.

MUNICIPAL GOVERNMENT: City of Gloucester, City of Kanata, City of Nepean, City of Ottawa, City of Vanier, Township of Cumberland, Township of Goulbourn, Township of Osgoode, Township of Rideau, Township of West Carleton, Village of Rockcliffe Park.

OTHER SOURCES: Canadian Petroleum Products Institute, City of Toronto Environmental Protection Office, Chemlawn Inc., Consumers Gas, Coordinating Committee for Water Quality in the Ottawa River, Fondex Limited, Ottawa-Carleton Regional Housing Authority, Ottawa Hydro, the Citizen, the Globe and Mail, the Montreal Gazette, Technical Pollution Abatement Committee.

LIBRARIES: Canada Mortgage and Housing Corporation, Carleton University, CISTI-National Research Council Library, Environment Canada, Ottawa-Carleton Health Department, University of Ottawa, RMOG Resource Centre.

The report was also reviewed by the Environmental Health Advisory Committee to the Health Department. Members include:

Mr. Dale Cameron
Environment Canada

Mr. George Clark
Ministry of the Environment

Dr. Ted Gregor
Ministry of Labour

Mr. Richard Denham
RMOG Environmental Services

Mr. Jack Mobley
Community Representative

Ms. Jane Scott
Community Representative

Mr. P. A. Perumal
Community Representative

Ms. Susan Springthorpe
Community Representative

Mr. F. C. Boyd
Community Representative

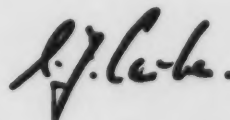
Mr. Bhoo Agarwall
Community Representative

Dr. E. Ellis
Associate MOH
Ottawa-Carleton Health Dept.

Mr. Al Raven
Environmental Health Directorate
Ottawa-Carleton Health Dept.

Ms. Martha Robinson
Public Health Inspector
Ottawa-Carleton Health Dept.

Ms. Lorna Brownlee
Environmental Health Analyst
Ottawa-Carleton Health Dept.



Dr. S. J. Corber
Medical Officer of Health

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LIST OF ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	microgram per cubic meter
3Rs	Reduce, reuse recycle
4Rs	Reduce, reuse, recycle, recover
ANSI	Areas of natural and scientific interest
APC	Aerobic plate count
AQI	Air quality index
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
BOD	Biological Oxygen Demand
Bq/L	Becquerels per litre
CAP	Clean Air Program
CDWG	Canadian Drinking Water Guidelines
CEPA	Canadian Environmental Protection Act
cfm	Cubic feet per metre
cm	Centimetre
CMHC	Canadian Mortgage and Housing Corporation
CO	Carbon Monoxide
dB	Decibels
DWSP	Drinking Water Surveillance Program
EAA	Environmental Assessment Act (Provincial)
EFW	Energy from waste
EMF	Electromagnetic Fields
EPA	Environmental Protection Act (Provincial)
FC/100 mL	Fecal coliforms per 100 millilitres
ft	Feet
Ha	Hectares
Hz	Hertz
IPM	Integrated Pest Management
Kg	Kilograms
L	Litres
mg/L	Milligrams per litre
mg	Milligrams
MISA	Municipal/Industrial Strategy for Abatement Program
MNR	Ontario Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
NCC	National Capital Commission
NEF	Noise Exposure Forecast
ng/L	Nanograms per litre
NO	Nitrogen Oxide
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
ODWO	Ontario Drinking Water Objectives
OMAF	Ontario Ministry of Agriculture and Food
OMOL	Ontario Ministry of Labour
PAHs	Polynuclear Aromatic Hydrocarbons
PANs	Peroxyacetylnitrates

PCBs	Polychlorinated Biphenyls
ppb	Parts per billion
ppm	Parts per million
RMOC	Regional Municipality of Ottawa-Carleton
RVCA	Rideau Valley Conservation Authority
SBS	Sick Building Syndrome
SO ₂	Sulphur Dioxide
SOE	State of the Environment
THMs	Trihalomethanes
U.S. EPA	United States Environmental Protection Agency
UFFI	Urea Formaldehyde Insulation
US	United States
VOC	Volatile Organic Compound
WHO	World Health Organization
WMMP	Waste Management Master Plan
yd	Yard

INTRODUCTION

The 1980s and 1990s have brought a new awareness of the environment and its potential impact on the earth's inhabitants. The seeds of today's environmental problems were sown years ago, often unwittingly, sometimes through carelessness. This State of the Environment Report marks our Region's determination not to pass such problems on to our children. By correcting past problems, by learning more about the health effects of pollutants and by moving to sustainable development we can meet this goal.

The Ottawa-Carleton Health Department is committed to the promotion of optimal health for the Region's population. This involves controlling the spread of disease through monitoring and enforcement programs, providing health care resources and promoting health through educational programs.

An important function of the Health Department is to listen and respond to the public's health concerns. The Health Department shares these concerns. There is a vital link between health of the environment and quality of life, and between the Health Department and the Region's citizens. The will to create change depends on the determination and cooperation of all concerned. As a first step, the Health Department must determine the current state of our environment and identify areas of current or potential health impact.

1.0 STATE OF THE ENVIRONMENT REPORTING

State of the Environment (SOE) reporting is the systematic acquisition, analysis and presentation of information on environmental conditions and trends¹ within a defined area. It is currently being encouraged on a global, national, regional and local level. Canada produced its first SOE report in 1986. From this report came the 1990 "Greenplan". SOE reports should be prepared regularly to track improvement in and/or deterioration of the environment.

Because it describes an environment that may have endured years of neglect, indifference and abuse, the first SOE report may seem negative. However, SOE reporting is part of the process of acknowledgement and accountability, and is thus a positive step towards a healthy environment. Indeed, SOE reports are the basis for a systematic approach to remedial action by the governments involved.

This report examines the environment of the Regional Municipality of Ottawa-Carleton (RMOC) in terms of its air, water and land and its impact on human health. Outdoor air quality is a function of the geography of the area and the pollutants that are emitted into the air. Indoor air quality, although not usually included in SOE reports, is an important aspect of environmental health. Ground and surface water are important to environmental health as sources of drinking water. The Region's rivers are also important for recreation. Land issues are far-reaching and various; the two main land-related aspects of environmental health examined in this report are recreational use and solid waste management; other environmental issues of public health concern are also included.

2.0 THE ENVIRONMENT-HUMAN HEALTH LINK

The way we use our environment in both urban and rural settings affects human health. Human activities and development have direct and indirect impact on our air, water and land. In turn, the state of our air, water and land affects our lives and health.

Air quality affects people's ability to breathe and to carry out their activities. Directly, contaminants such as asbestos fibres or lead can cause permanent damage to health. Indirectly, poor air quality reduces our enjoyment of clear skies and outdoor activities.

Water quality also affects health directly and indirectly. Directly, bacterial and chemical contaminants in drinking water and recreational water can cause intestinal or neurological diseases. Indirectly, polluted water can be aesthetically unpleasant, causing weed-choked rivers and bad tastes and odours in drinking water.

Pollution of the land can cause visible and immediate hazard when fire threatens stockpiled chemicals such as PCBs or tires. However, most hazards are much less visible: for example, skin contact with household chemicals and pesticides, vegetables from land contaminated with heavy metals, lack of ground-water-regenerating wetlands, or methane and leachate production from aging landfill sites polluting air and water. Even noise and electromagnetic fields are important but invisible land issues. All these forms of land pollution — direct and indirect, visible and less visible — affect human health and quality of life.

3.0 FACTORS INFLUENCING ENVIRONMENTAL HEALTH

3.1 HISTORY

The environmental health problems in Ottawa-Carleton are typical of any urban centre and are concerned mainly with the uncontrolled release of human-generated pollution into the air, water or land. First settled in 1800, Ottawa started as a rough lumber town at the junction of the Ottawa and Rideau rivers. The Ottawa Valley's huge stands of red and white pine provided the town's industrial base. After the War of 1812 with the United States, the Rideau Canal (1826-1832) was built under the command of Colonel John By to provide a secure internal supply route safe from invading U.S. forces. In 1857, Queen Victoria picked Ottawa to become the capital of the new province of Canada. Ottawa was centrally located, politically acceptable to Upper and Lower Canada, a reasonable distance from the United States and provided a beautiful natural setting. Thus the Region developed as a government town, isolated from the United States and distant from the cheap power that would have provided the basis for a heavily industrialized economy.

3.2 GEOGRAPHY

The climate in built-up urban areas is on the average a little warmer, less humid, less rich in solar radiation, less windy, cloudier and rainier than the local rural environment.² This phenomenon is referred to as an "urban heat island". There are many days when these conditions are pronounced in urban centres, causing considerable adverse effects on health, comfort, economic activity and movement. Because of local topography, this phenomenon is exaggerated in Ottawa-Carleton.

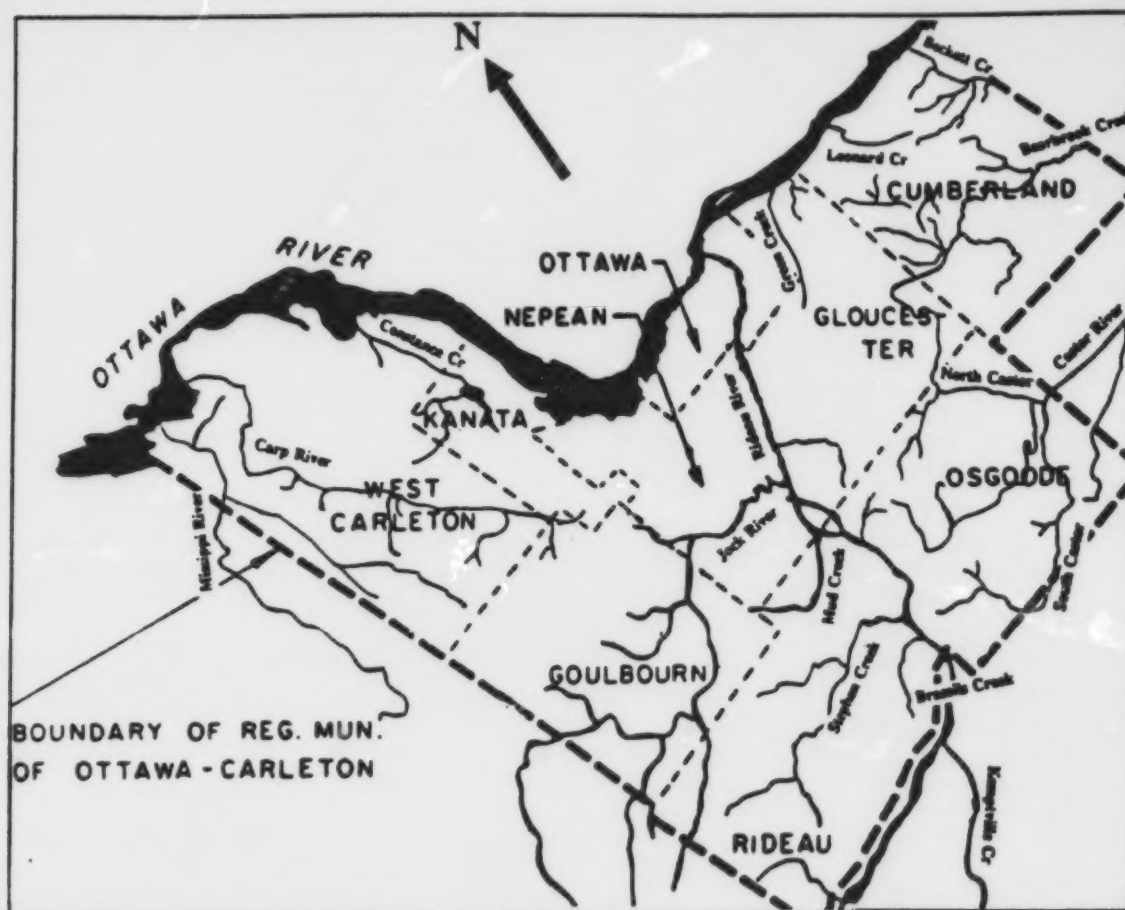
The physical topography of the Region plays an important role in our outdoor air quality. The valley created by the Gatineau Hills and the Ottawa River can trap air pollutants, inhibiting their removal from the area. Pollution is usually mitigated in urban areas by strong winds and natural ventilation, which dilute and disperse contamination. This natural clean-up occurs when warm air from urban centres is drawn upwards to cooler temperatures at higher elevations.² However, these conditions are often absent. Like the mountainous valleys of British Columbia and the shorelines of the Great Lakes, the Ottawa River Valley frequently has surface winds of less than 3 metres per second, potentially allowing high concentrations of photochemical pollutants to build up.³

Under such conditions, a temperature inversion may follow. In a temperature inversion, the air at upper levels is hotter, instead of cooler, than at ground level. The polluted air below cannot rise through the heated upper level and is trapped close to the earth's surface. Temperature inversions, in conjunction with light winds, are responsible for most of the air pollution episodes in urban areas. Temperature inversions occur on a daily basis in the Region. Most do not last long enough to cause serious pollution accumulation.

The Ottawa-Carleton Region has two major bodies of water: the Ottawa River and the Rideau River; two small lakes: McKay Lake in Rockcliffe Park and Constance Lake in Kanata; and several small tributaries. Figure 1 shows the water courses in Ottawa-Carleton.

The Ottawa River is by far the Region's largest water source, having an average flow just under 2000 cubic metres per second.⁴ It originates in Northern Quebec and flows through the Region to the

Figure 1 Water Courses in Ottawa-Carleton



St. Lawrence River. Hydroelectric energy generation, domestic water supply, municipal waste water disposal and recreation are the major uses of the Ottawa River today.⁵ The Ottawa is the major drainage basin for the Region. Its tributaries on the Ontario side include: the Mississippi River (Gody Creek tributary), Carp River, Constance Creek, Shirleys' Brook, Graham Creek, Watt's Creek, Rideau River, Green Creek (including McEwen and Borthwick creeks), Bilberry Creek, Leonard Creek, Beckett Creek, Bearbrook Creek and the Castor River (including South, Middle and North Castor rivers). The Gatineau River and the Du Lievre River enter the Ottawa River from Quebec.

The Rideau River originates in the Rideau Lake system, winds through the centre of the Region and empties into the Ottawa River. The Rideau River and Canal, including Dow's Lake, is a recreational favourite, particularly for boating and swimming. The Rideau River is also an important drainage basin within the Region. Its tributaries include: Brassils Creek, Cranberry Creek, Steven Creek, Mud Creek, Jock River, Mosquito Creek, Black Rapids Creek, Uplands Creek, Nepean Creek, and Sawmill Creek.

3.3 THE POPULATION DISTRIBUTION

The RMOC was formed on January 1, 1969, and has a total population of 658 789.⁶ The Region is composed of six cities: Gloucester, Kanata, Nepean, Ottawa, Rockcliffe Park and Vanier; and five townships: Cumberland, Goulbourn, Osgoode, Rideau and West Carleton. The Region is the fourth largest municipality in Canada. Seven per cent of the total land base is urban; the remainder is rural with a strong agricultural component.

According to 1986 census data, 91% of Ottawa-Carleton residents live in urban areas, 8.9% in rural, non-farm areas and 0.1% live on farms. It is predicted that by 2011 the population will have increased to 871 000. The cities of Ottawa, Vanier and Rockcliffe Park will experience minimal growth. The major growth areas will be Nepean, Gloucester, Kanata and Cumberland.

The Regional Planning Department classifies the population as either rural, urban within the greenbelt or urban outside the greenbelt. These classifications transcend municipal boundaries. Contained within the greenbelt are the cities of Ottawa, Vanier, Rockcliffe Park and the northern section of Nepean. To the east of the greenbelt is Orleans, located on the boundary between Gloucester and Cumberland. Orleans is one of the fastest growing urban centres in Canada. South of the greenbelt in Nepean is Barrhaven and to the west is Kanata.

Figure 2 Projected Population Growth in Relation to the Greenbelt

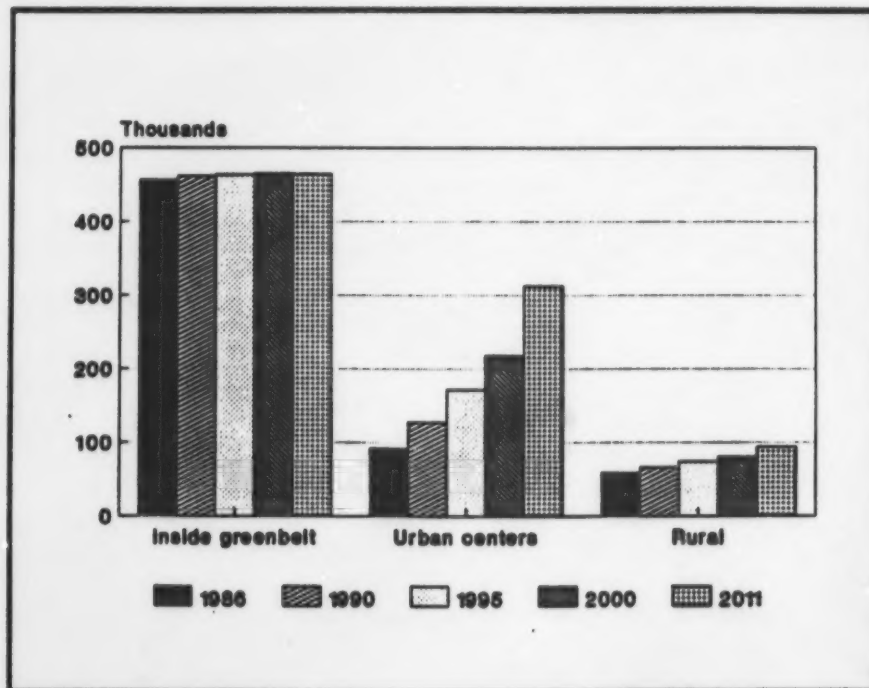
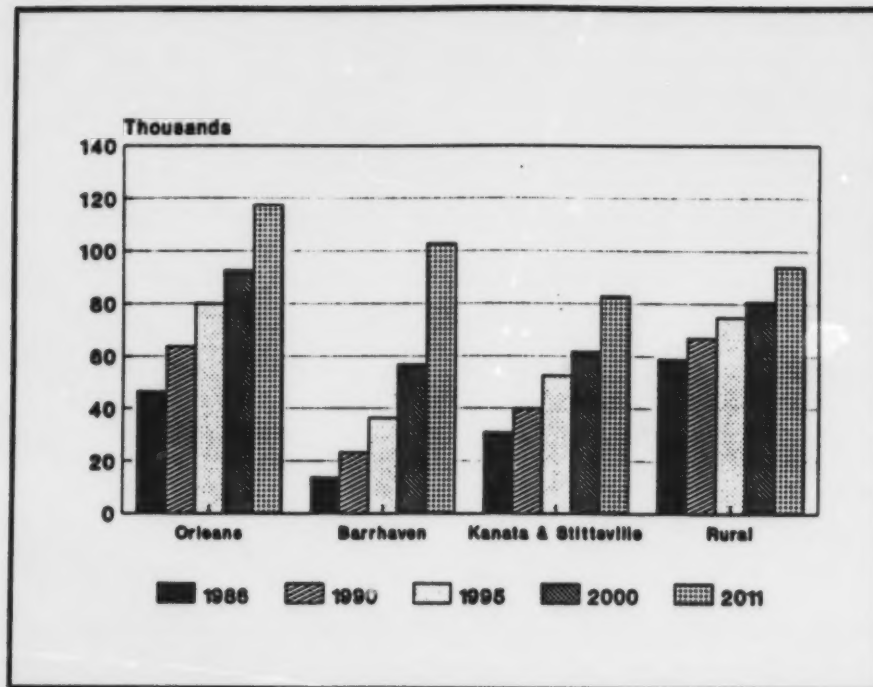


Figure 3 **Projected Growth Outside of the Greenbelt**



In the next 20 years, population growth within the greenbelt will be static, while the other urban centres will triple and the rural areas will almost double the 1986 population (Figure 2). The projected growth of each urban centre and the rural area is given in Figure 3. By 2011, the population outside the greenbelt will equal that inside the Greenbelt. Barrhaven is expected to undergo the most rapid growth in the next 20 years.

3.4 URBAN DEVELOPMENT AND CONVERSION OF RURAL AND VACANT LAND

Environmental contamination of air and water has the potential to affect the health of many people. In contrast, contamination on land is relatively immobile and more easily contained. Land contamination becomes a problem when ground or surface waters become contaminated or when the use of the land changes. Historically, the abundance of vacant land within the Region has allowed us to isolate polluting land uses from populated areas, minimizing any affects on community health.

However, the last 30 years has been a period of rapid population growth. As the population moves out of the original downtown core to establish new urban areas, rural and vacant land is rapidly being consumed. Previously polluted land and ground water may be needed for residential use.⁷ Urbanization often produces what is called the "urban shadow", removing productive farm land from use when the land becomes more valuable as development land than as farmland. Between 1981-86, 3588 hectares (ha) of rural land in the Region was converted for urban use – approximately 50 ha for every 1000 increase in population. In 1981, 33.6% of the 3588 ha was still actively farmed, 9.8% was abandoned farm land, 20.7% was land "in transition" and 34.3% had no perceived activity (predominantly trees or unimproved land covered in wild grasses or shrubs). In terms of agricultural quality, 62.3% was classified as prime agricultural land (Classes 1-3); 22.1% had low capability and 15.6% was either organic land, had no capacity or was unclassified.

Figure 4 25 Year Trend in Urban Land Use Inside the Greenbelt, 1961-1986.

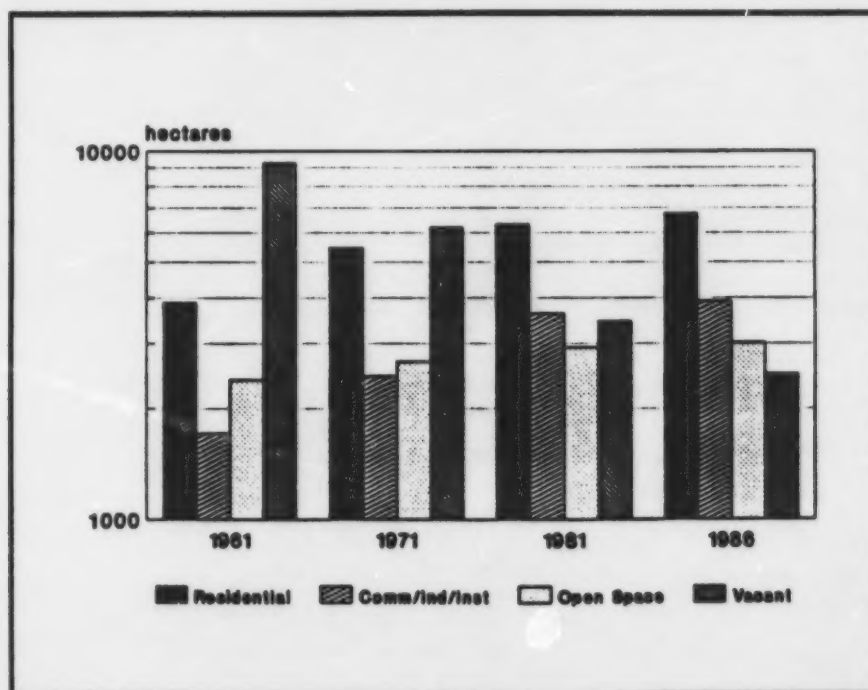


Figure 5 25 Year Trend in Urban Land Use in the Urban Centres, 1961-1986.

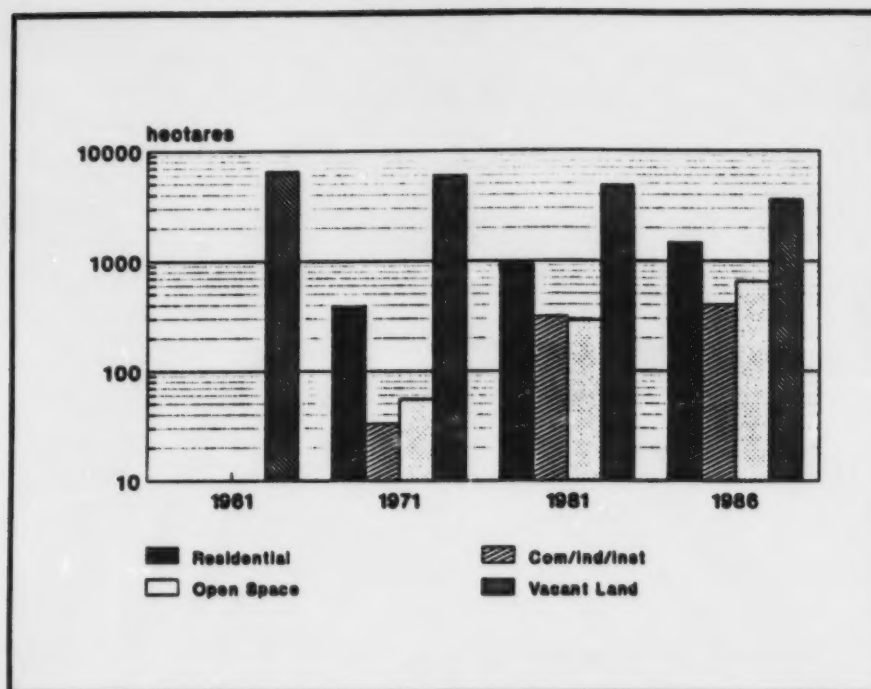


Table I Urban Land Consumption by Use, 1981-86

Land Use Type	Inside Greenbelt		Urban centres		Total Urban	
	ha	%	ha	%	ha	%
Residential	454	55%	539	54%	993	55%
Commercial	66	8%	21	2%	88	5%
Industrial	169	20%	35	4%	205	11%
Institutional	52	6%	34	4%	86	5%
Recreation/ Open Space	87	11%	362	36%	449	25%
Total Developed	828	45%	992	55%	1820	100%

The 25-year trends in land use from 1961-1986² are illustrated in Figure 4 (greenbelt) and in Figure 5 (urban areas). During this time, urbanized land in Ottawa-Carleton doubled to approximately 19 500 hectares and the population increased by 70%. The most visible change in the last 25 years is the filling in of available land within the greenbelt and the growth of urban centres. In 1961, no development of urban centres had occurred. By 1986, 55% of the newly urbanized area was in the urban centres of Orleans, Kanata and Barrhaven (Table I). This is the first time that land consumption in the urban centres was greater than inside the greenbelt. Low-density residential development in the urban centres outside the greenbelt was the single largest component of land use, accounting for 25% of the total urban land consumption in the Region. Within the greenbelt the proportion of medium- and high-density housing was greater.

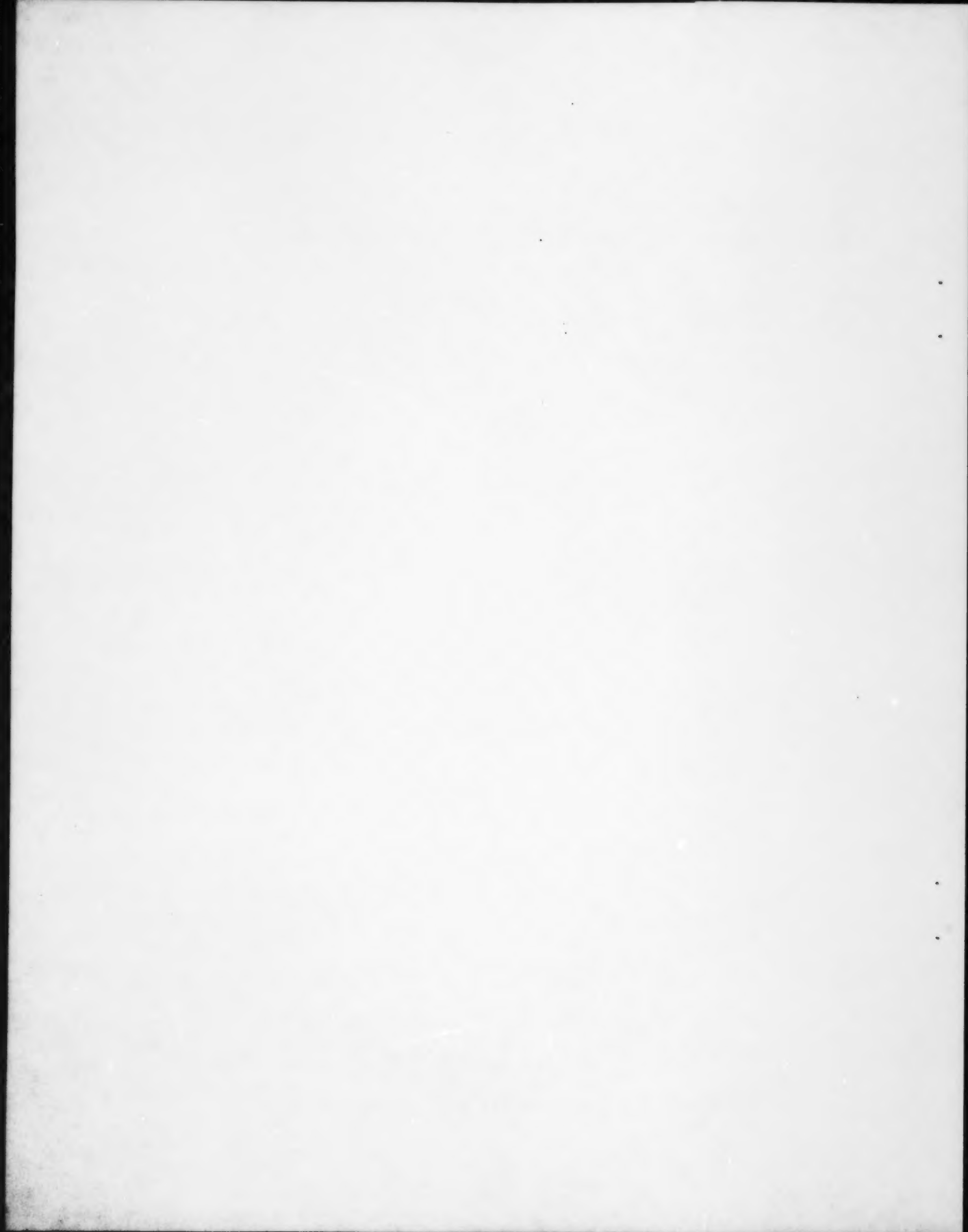
This rapid population increase outside the greenbelt has major implications for the development of Regional services and supporting development. Schools and recreation facilities must be increased to accommodate the young families that make up the increased population. The urban centres are already serviced by Regional sewage and water but these facilities too will require expansion to maintain adequate supply.

The 10% of the population located in the rural areas will present special challenges. Most of these people will live in small rural municipalities serviced by private septic systems and wells. Providing safe and adequate water will require regular monitoring of underground aquifers. As the density of the rural population increases, so does the potential for water contamination.





AIR 



A. INTRODUCTION

Air is made up of nitrogen, oxygen, carbon dioxide and small amounts of inert gases. It also contains small amounts of water vapour and a variety of natural and artificial pollutants. The type and concentration of these pollutants determine the quality of air in both outdoor and indoor environments.

Air quality has a direct impact on human health, with consequences ranging from mild discomfort to acute illness. Some of the common health effects associated with poor air quality include headaches, dizziness, eye and throat irritation, dry skin and skin rashes, nausea, drowsiness and fatigue. Individual reactions to air pollutants are dependent on the concentration of the pollutant, the length of exposure and individual susceptibility.⁹

This section of the State of the Environment report is divided into two components: outdoor air and indoor air. *Outdoor air* quality focuses on the ambient air quality and specific air pollutants of concern in the Region. Sources of pollutants and current initiatives to improve outdoor air quality are also covered.

Indoor air quality focuses on the principle pollutants found in indoor environments, their sources and human health effects. Common indoor air problems in the home and workplace, testing for pollutants, and initiatives for improved air quality in the Region are discussed to give a sense of the common problems and their solutions.

B. OUTDOOR AIR

Ottawa-Carleton has few large point sources of air pollution. Despite the Region's topography, there is enough natural ventilation to disperse most air pollution before it affects the health of area residents. However, like all metropolitan centres, the urban centres in the Region are affected by local air pollution sources. We are also affected by pollution sources outside of the Region. The combination of weather conditions, intensity of emissions and the location of air pollution sources determine the ambient air quality on any given day.¹⁰

B.1. AMBIENT AIR QUALITY

In Ontario, air quality in cities is measured by the air quality index (AQI). This index measures the ambient (or general background) level of outdoor air pollution. The five common air pollutants in the air we breathe are ozone, suspended particulates, carbon monoxide, nitrogen dioxide and sulphur dioxide. These air-quality parameters are continuously monitored and reported to the public four times a day as the AQI.

B.1.1 AIR QUALITY INDEX

Ambient air quality was measured using the Air Pollution Index until July 1988 in Ottawa, when it was replaced by the AQI which provides more detailed information. The air quality index is operated by the Ontario Ministry of the Environment (MOE).

Most pollutants are measured on a continuous basis and *Ontario Regulation 296* sets out maximum concentrations for the most common air pollutants in 1-hour, 8-hour and 24-hour periods. These criteria reflect short- and long-term human health effects of the pollutants. In some cases annual criteria are set out. The annual criterion reflects the average or geometric mean result for that pollutant during the year. Each of the pollutants is measured independently and indexed on a scale of 0 to 100+. Values over 50 exceed the concentration allowed for that pollutant over a 1-hour interval. The pollutant with the highest index is reported as the AQI reading.

The AQI scale is divided into five levels (Table II). When the AQI indicates an air quality problem, it is reported by the MOE more frequently to keep the public better informed. Industries that contribute to air pollution can be asked by the MOE to reduce or stop production during periods of poor or very poor air quality.

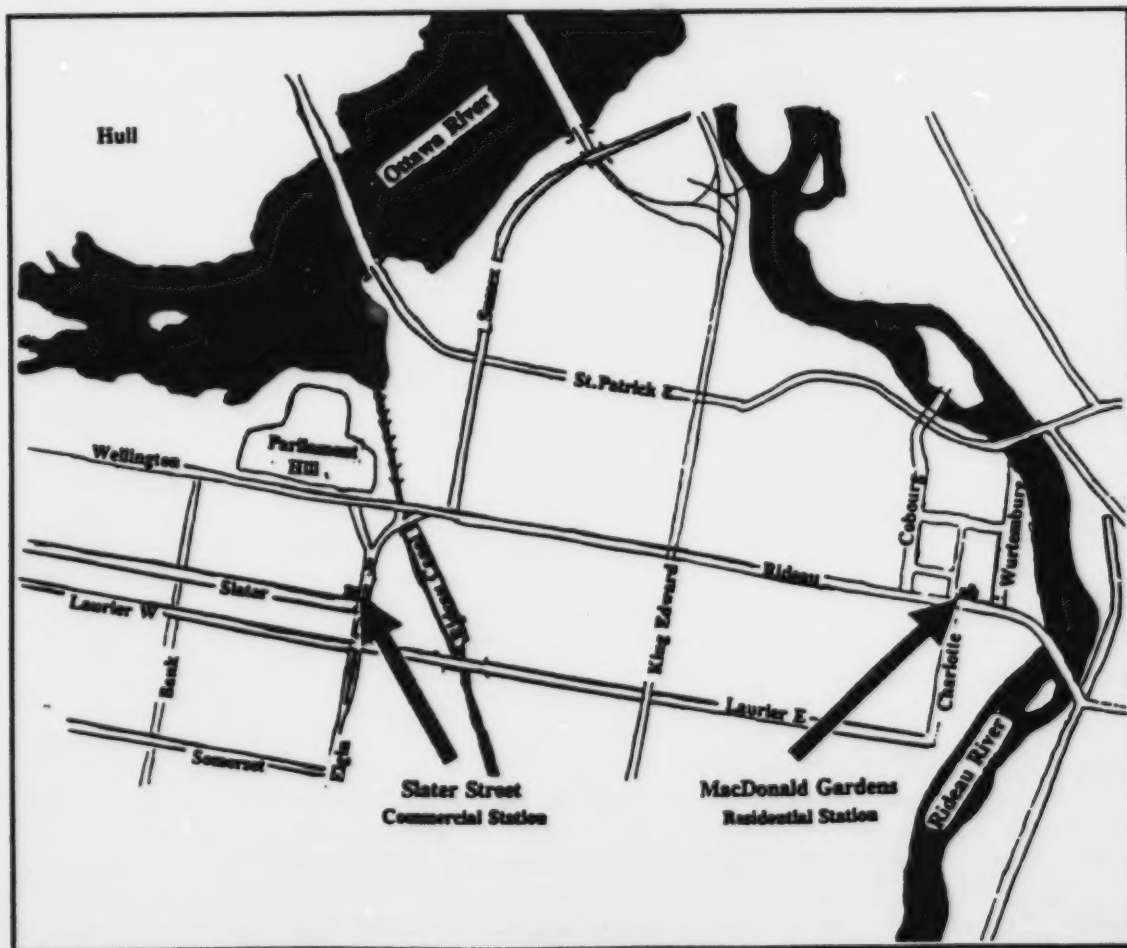
B.1.2 LOCATION OF AIR MONITORS

There are currently two air monitoring stations in the Region, both located within the City of Ottawa (Figure 6). The monitoring station located at 88 Slater Street at Elgin Street is operated by Environment Canada and monitors downtown and commercial ambient air quality. Its location on a major transit route for both buses and cars reflects the influence of transportation vehicles, a major air pollution source in the Region. The monitoring station at MacDonald Gardens on Wurtemburg Street near Rideau Street is operated by the MOE. It measures residential ambient air quality. Originally there were four monitoring stations operating in the Region but the lack of difference in readings from stations in similar areas resulted in the reduction to two stations.

Table II Air Quality Index Levels

AQI Index Reading	Level
0 - 15	Very Good
16 - 31	Good
32 - 49	Moderate
50 - 99	Poor
100+	Very Poor

Figure 6 Location of Outdoor Air Quality Monitoring Sites



B.1.3 AMBIENT AIR QUALITY RESULTS

Ambient air quality in the residential urban areas of the Region falls into the "very good" category of the AQI most of the time. Between 1978-1988 ambient air quality was very good more than 99% of the time.¹¹ Table III shows the frequency of the categories of the AQI in 1989 at the residential monitoring station. The results are representative of urban residential neighbourhoods in the Region.

Table III Ambient Air Quality: MacDonnell Gardens

AQI Category	Number of Hours in 1989	Percentage of Time
Very Good	7829	89.6%
Good	876	10.0%
Moderate	36	0.4%
Poor	0	0%
Very Poor	0	0%

Air quality in the commercial area is generally of poorer quality than that found in the residential sections, due to the higher traffic volume. The MOE does not compile an AQI at the Slater Street location, as AQI scales are designed to reflect ambient air in residential settings.

B.2. COMMON AIR POLLUTANTS

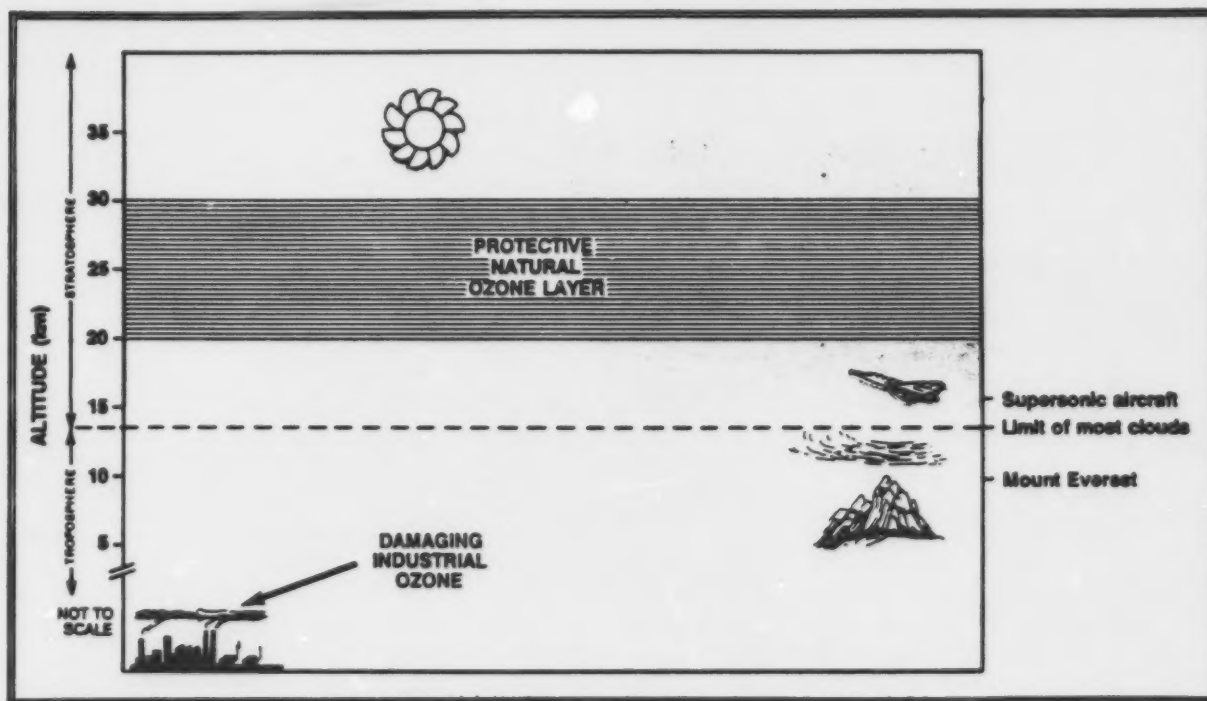
Common air pollutants that make up the bulk of contaminants in outdoor air in the Region are ozone, total suspended particulates, carbon monoxide, nitrogen oxides and sulphur dioxide. Other outdoor air pollutants such as benzene, formaldehyde and dioxins may be present but occur in such small quantities that it is not possible to measure them continually. These trace pollutants are measured primarily when a problem is suspected from a known source. Sections I.B.2.1 to I.B.2.6 describe the pollutants and their health effects in order of importance in our Region.

The AQI monitors the overall air quality in relation to provincial criteria. It is a composite index and does not report concentrations of individual pollutants. Significant changes in air quality parameters within the Region must be examined individually. In Figure 8 to Figure 14, average levels of the pollutants are shown at both residential and commercial monitoring stations and are given as annual means except where indicated.^{12&16} Whenever possible, control data from the town of Dorset, located just west of Algonquin Park in southern Ontario, are included for comparison. Dorset is removed from most man-made sources of air pollution and represents relatively unpolluted air.

B.2.1 OZONE

The environmental health properties of ozone are dependent on whether it is located in the upper or lower atmosphere. About 90% of the earth's ozone is in a natural layer in the stratosphere far above the surface of the earth (Figure 7).¹³ Here, naturally occurring ozone provides protection from harmful ultraviolet radiation. In the lower atmosphere ozone is a secondary pollutant. It is a by-product of photochemical reactions between reactive pollutants such as hydrocarbons and nitrogen oxides in the presence of sunlight. Ground-level ozone is one of the components of smog, which we can observe as a brown-grey coloured haze that blankets urban areas on hot, windless days.

Figure 7 Ozone in the Atmosphere

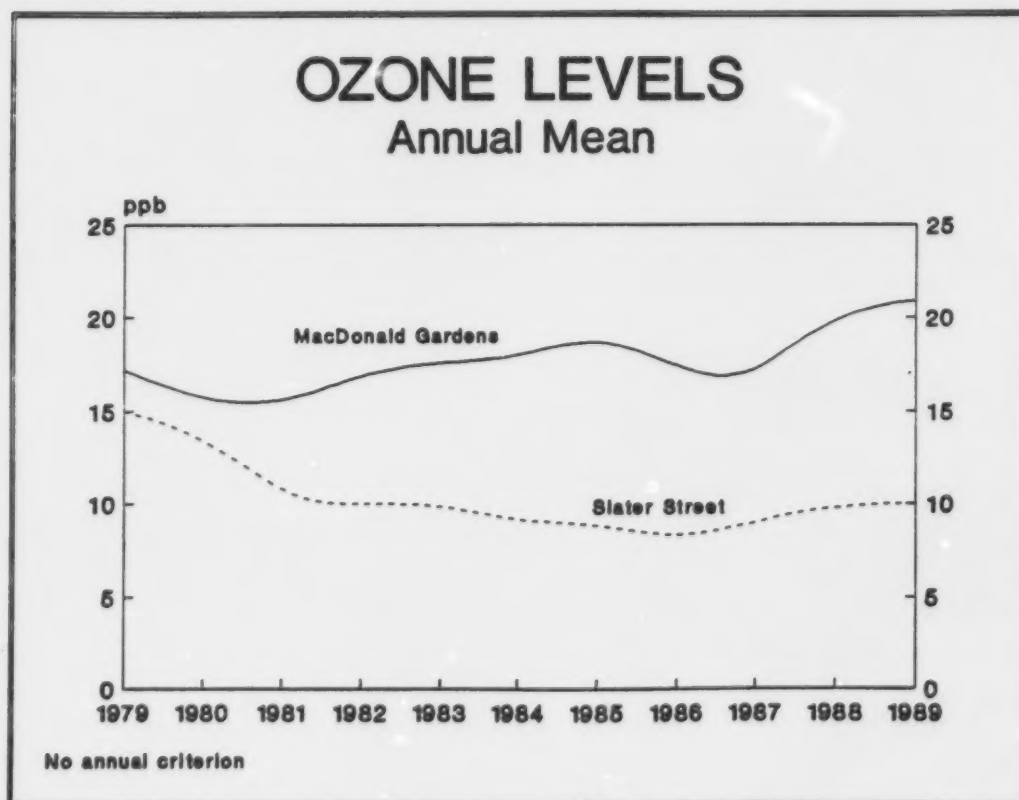


High levels of ozone can irritate the nose and throat, and impair lung function in susceptible individuals and those with heart and circulatory system problems. People engaging in exercise have decreased lung function when ozone levels are higher. Regional ozone levels have been lower than the Ontario limit 99% of the time in the past decade.¹¹ Despite this, ozone causes over 80% of the Region's air quality incidents.¹¹

Ozone levels are, on average, higher at the residential monitoring station at MacDonald Gardens than at the commercial monitoring station, despite the fact that the major source of ozone is automobile emissions. Figure 8 shows the average ozone levels measured in Ottawa over the past eleven years. There is no annual criterion for ozone.

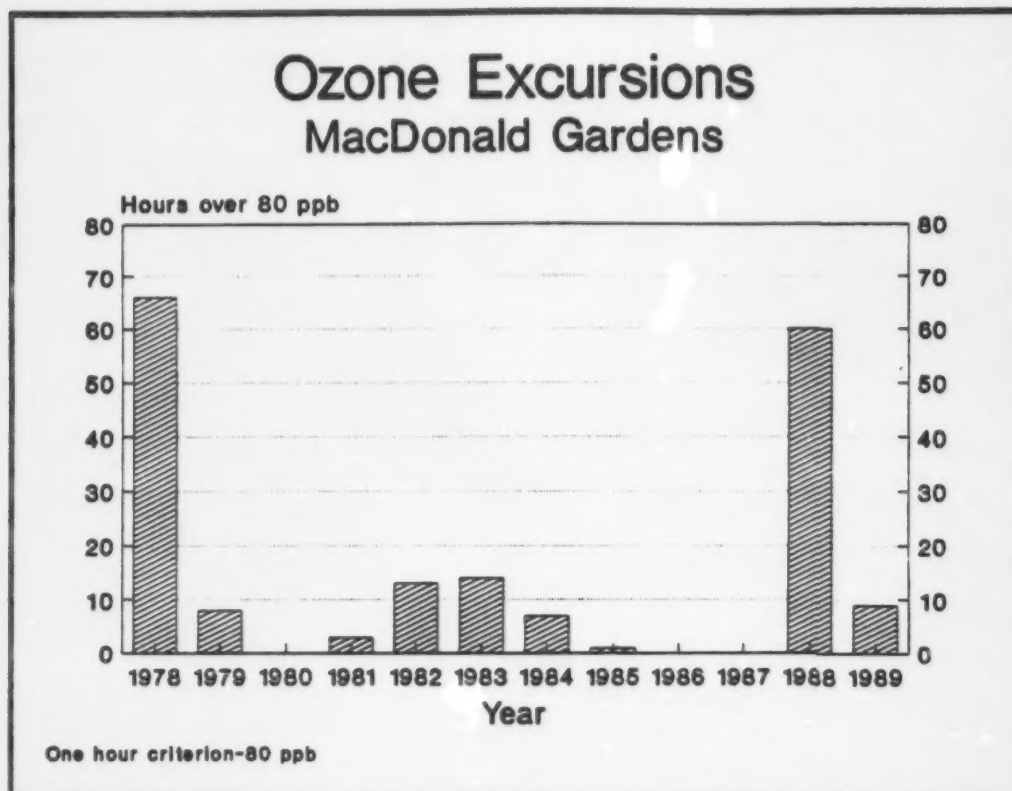
The photochemical reactions that produce ozone take time to complete, and it is not until the pollutants are carried downwind of urban sources that ozone is formed. An example of this phenomenon is illustrated by the higher ozone levels found at Dorset than at MacDonald Gardens due to the long-range transportation of the components of ozone from southern Ontario and the eastern United States. See Section I.B.3.4 for more detail.

Figure 8 Average Ozone Levels



Ozone levels are very dependent on weather conditions, especially temperature inversions. Seasonally high levels occur in the spring and summer when the 1-hour criteria of 80 parts per billion (ppb) may be exceeded frequently. Figure 9 illustrated the number of hours ozone levels exceeded the 1-hour criterion of 80 ppb between 1978 and 1989.

Figure 9 Ozone Excursions



B.2.2 TOTAL SUSPENDED PARTICULATE

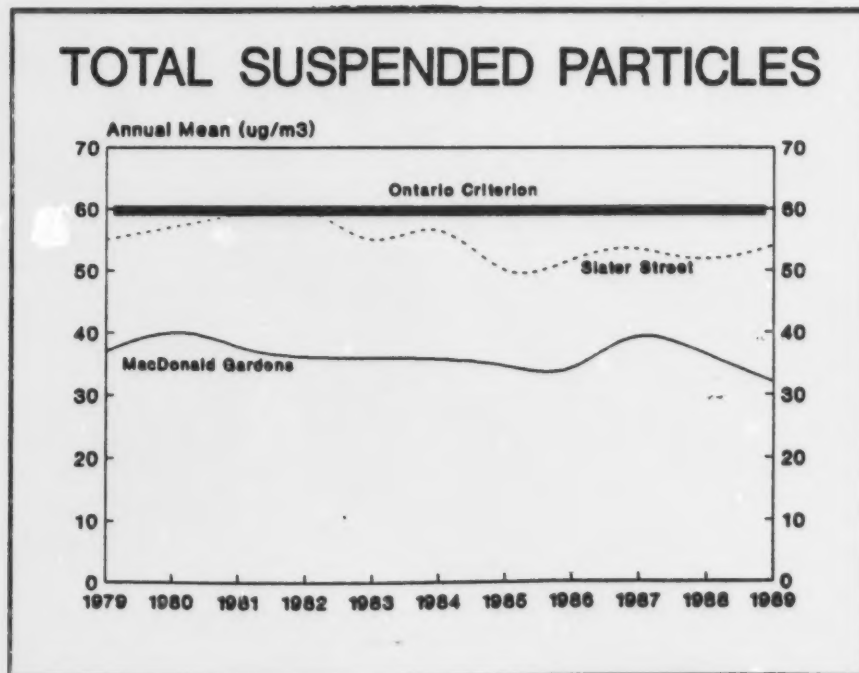
Total suspended particulates are airborne particles ranging from 0.1 to 100 micrometres in diameter. Inhaled particles can irritate the respiratory system, and repeated and prolonged exposure to some types of particulates appears to increase the likelihood of chronic respiratory disease. Major sources of suspended particles in the Region include wind-blown soil, pollen, construction dust and particles from combustion in automobiles and furnaces.

Suspended particulate (SP) is the second most common cause of high AQI readings in the Region. Incidents of high suspended particulate are sporadic and are not considered a chronic problem. Windy days produce high levels of suspended particulate. Levels are relatively high at the commercial monitoring site on Slater Street which is a busy traffic corridor, and much lower in the residential neighbourhood. Slater Street is heavily influenced by downtown construction activities, automobile and diesel bus exhaust.

It is estimated that 10-15% of people suffer from allergies to pollens, moulds and fungi.¹⁴ Tree pollens are prevalent from April to May, grass pollens in June and July, and ragweed pollen from August to September. Mould spores are most common in spring and fall. The Ottawa Valley is prone to high pollen counts when poor natural ventilation prevents dispersal of pollens.

Figure 10 shows the trend of suspended particle levels over the past 11 years at the two Ottawa stations. The Ontario criterion for 24 hours is 120 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) and the one year geometric mean criterion is 60 $\mu\text{g}/\text{m}^3$. The Dorset background level reading was 19 $\mu\text{g}/\text{m}^3$ in 1989, only a third as high as the Slater Street reading.

Figure 10 Total Suspended Particulate Levels

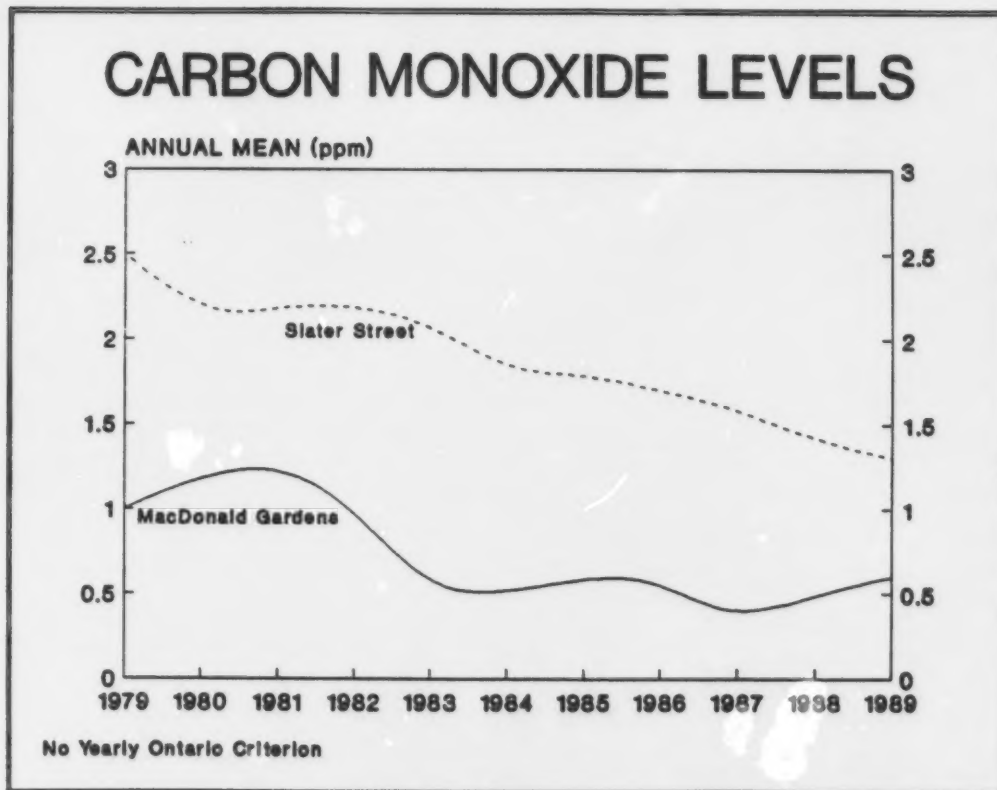


B.2.3 CARBON MONOXIDE

Carbon monoxide is a colourless, odourless gas that interferes with the blood's ability to deliver oxygen to body tissues and can also weaken heart contractions. High levels are considered harmful to everyone, but especially those with heart disease, respiratory disorders, anemia, and to cigarette smokers who already inhale larger than average doses of carbon monoxide.

In terms of total weight and concentration, carbon monoxide leads all other contaminants in urban air.¹⁵ Carbon monoxide results from the incomplete combustion of fuel, with motor vehicles contributing over 80% of emissions. Fossil fuel combustion from building heating systems and industrial operations is responsible for most of the remaining 20%. Pollution control equipment in cars has significantly reduced the output per car. This reduction has resulted in a 50% drop in the Region's carbon monoxide levels over the past 10 years. This decrease occurred despite the fact that vehicle traffic has been steadily increasing. Between 1984 and 1988 there was a 14% increase in the number of vehicles on the streets of Ottawa-Carleton. Figure 11 shows the 11-year trend in Ottawa, which indicates the declining levels at the Ottawa monitoring stations. The Ontario criterion for carbon monoxide is 30 parts per million (ppm) (1 hour) and 13 ppm (8 hours). There is no annual criterion.

Figure 11 Carbon Monoxide Levels



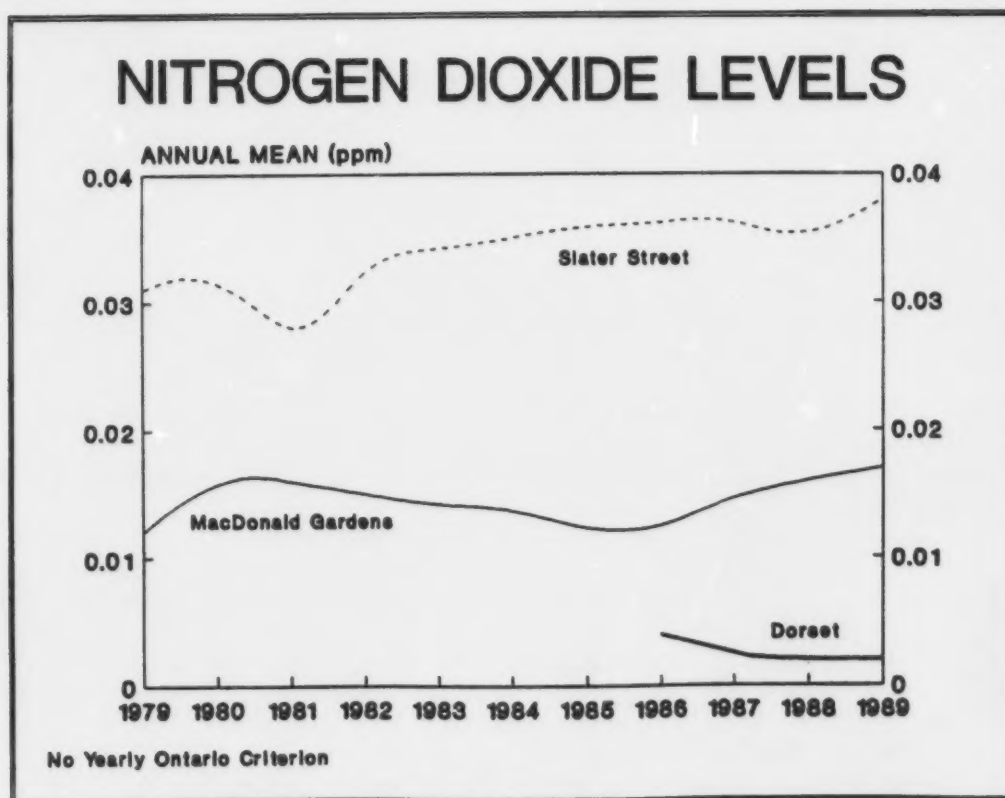
B.2.4 NITROGEN OXIDES

Nitric oxide is readily oxidized to nitrogen dioxide (NO_2), both in the atmosphere and in the membranes and tissue linings of human airways. Human exposure to oxides of nitrogen is associated with increased susceptibility to acute respiratory infections, lung irritation, and visual and olfactory disturbances. Nitric oxide can bind to hemoglobin to reduce the blood's oxygen-carrying capacity. Nitrogen dioxide is even more toxic; acute exposure can kill. Long-term effects of exposure to low levels are not well known. Nitrogen oxides also contribute to the formation of ozone and acid rain.

Sources of nitrogen oxides include all combustion sources such as oil- and gas-fired heating systems, motor vehicles, electrical power plants and incinerators. Total nitrogen oxides (NO_x) represent the sum of NO and NO_2 . There has been a greater than 40% reduction in NO_x emissions by weight from transportation vehicles since 1976.¹⁶

Figure 12 shows that NO_2 levels in Ottawa have increased slightly over the past 11 years. Higher levels in the commercial district are to be expected due to heavier traffic in the downtown core. Increased use of natural gas for home heating could explain the increased levels in the residential district. Dorset levels are much lower than Ottawa levels. Ontario criteria for NO_2 are 0.2 ppm (1 hour) and 0.1 ppm (24 hours). There is no Ontario criterion for NO as it so readily oxidizes to NO_2 .

Figure 12 Nitrogen Dioxide Levels

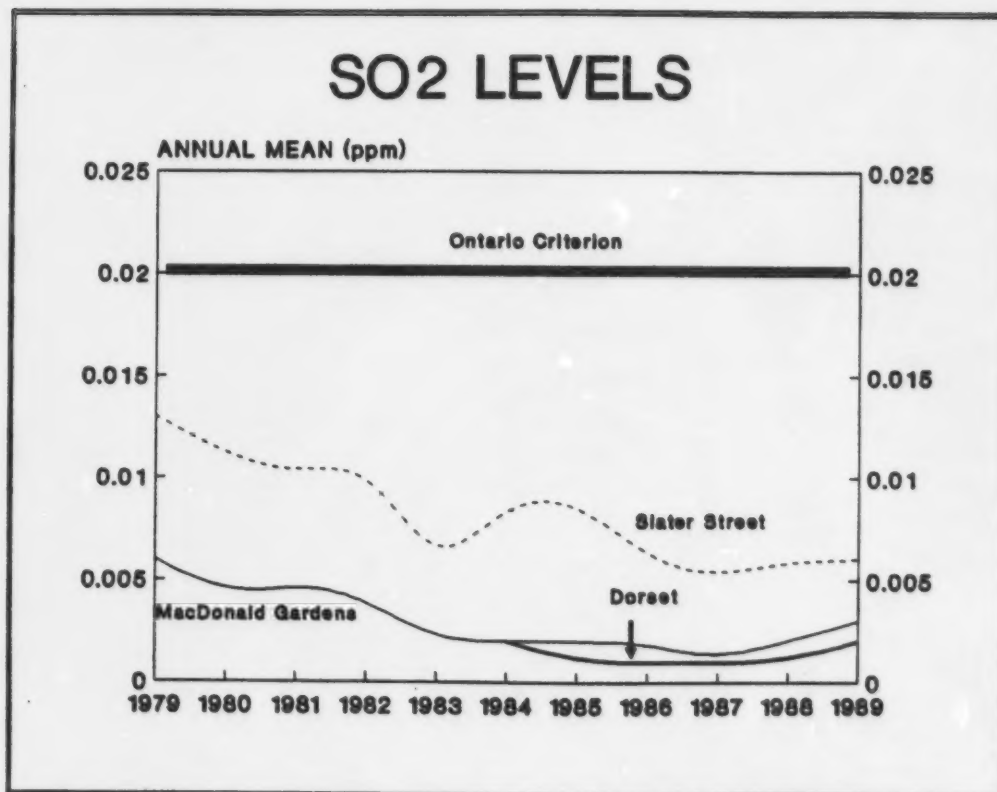


B.2.5 SULPHUR DIOXIDE

Sulphur dioxide (SO_2) is a highly soluble gas that is nearly completely absorbed in the nose and upper airway during quiet breathing. Concentrations above 0.5 ppm result in shortness of breath, especially in people susceptible to respiratory problems. Low-level concentrations cause distasteful odours, and irritate the eyes and lungs. The Ontario criteria for SO_2 levels are 0.25 ppm (1 hour), 0.1 ppm (24 hours), and 0.02 ppm (1 year).

Sources of SO_2 in the Region include pulp and paper mills, vehicles, and residential, commercial and industrial heating systems.¹⁷ The 30% decrease in SO_2 levels in the Region in the last 10 years can be attributed to heating oils with lower concentrations of sulphur, and the increased popularity of natural gas for home heating. Figure 13 shows the trend of SO_2 levels at the Ottawa monitoring stations over the past 11 years. Despite the fact that levels have dropped in the Region, SO_2 levels are still a concern due to burning of sulphur-bearing fuels for home heating.

Figure 13 Sulphur Dioxide Levels



B.2.6 PARTICULATE LEAD

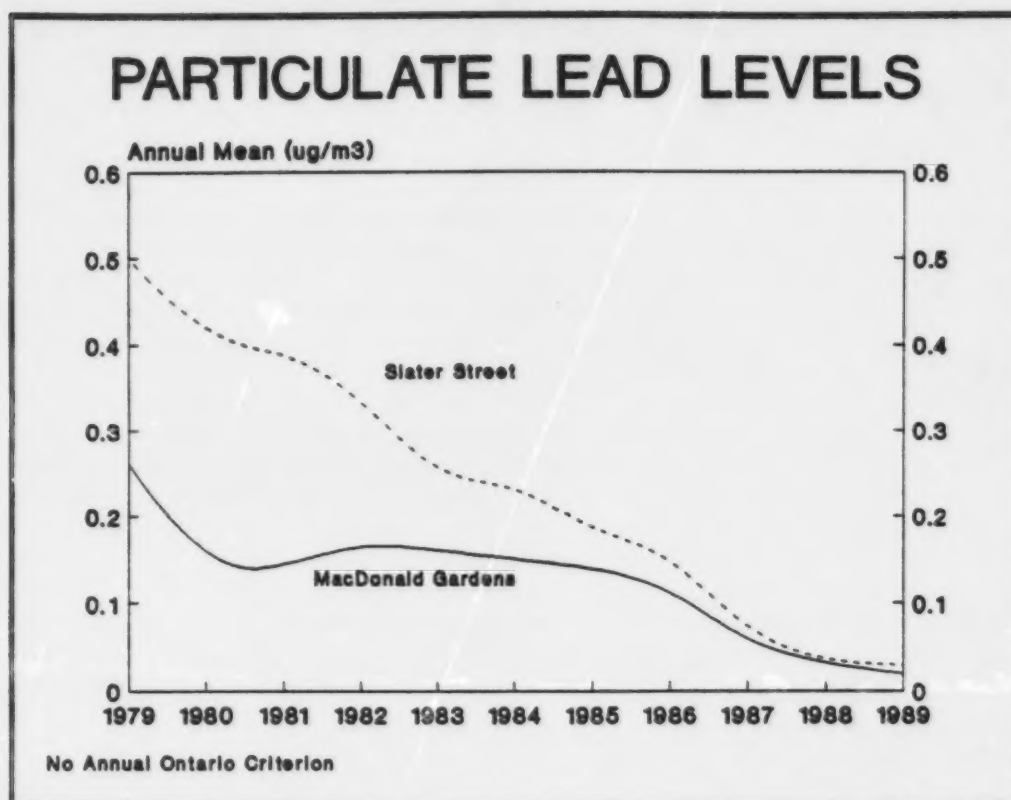
Lead is a heavy metal that is hazardous to humans if ingested or inhaled. Children under six and the growing fetus are at greatest risk from chronic low-level lead exposure. This is because children are more sensitive to lower lead levels than adults. High levels of lead exposure in growing children can affect the normal functioning of the urinary, blood and nervous systems.¹⁶ Associations between lead exposures, and physical and developmental growth such as learning behaviour, intelligence and neurobehavioral impairment deficits have also been documented.¹⁹

Children living in urban centres are thought to be at greater risk of lead exposure than children living in suburban or rural areas due to industrialization in these centres. Lead in food is the biggest source of exposure for adults and children, and inhalation of airborne particulate lead is now a low dose source of environmental exposure since lead was removed from gasoline. Two other sources of lead exposure include drinking water and, for young children, ingestion of soil and dust.

Lead is a component of total suspended particulate matter. Vast improvements in lead levels have been made over the past decade, such that the contribution of automobile emissions to ambient particulate lead levels has been virtually eliminated. Sources in ambient air include the continued use of leaded gasoline in farm and heavy-duty vehicles, secondary smelting of lead, and the production of batteries, paint, glass, iron, steel, copper and nickel.¹⁷ The fact that lead has been phased out of gasoline for passenger vehicles over the past few years, and that there is little primary industry in the Region, explains the low levels of particulate lead found at the air monitoring stations.

Figure 14 shows the trend for particulate lead in ambient air in Ottawa over the past 11 years. The Ontario criterion is $5 \mu\text{g}/\text{m}^3$ (24 hour) and $2 \mu\text{g}/\text{m}^3$ (30-day geometric mean) for lead in suspended particulate. Lead concentrations have steadily decreased with the phasing out of leaded gasoline.

Figure 14 Particulate Lead Levels



B.3 SOURCES OF AIR POLLUTION IN OTTAWA-CARLETON

Ottawa-Carleton is not a heavily industrialized centre, so large-scale point sources that contribute to air pollution in other urban centres are not a concern here. Industrial pollution sources located outside of our Region, such as hydroelectric generation plants, have an effect on our air quality when atmospheric conditions are favourable. Automobiles and space heating are the two major local sources of air pollution.

B.3.1 AUTOMOBILE EMISSIONS

Automobiles are the single largest source of air pollution in the Ottawa-Carleton Region. Between 60 and 75% of urban air pollution is attributed to cars. Vehicle emissions are both a source of primary pollutants such as carbon monoxide, hydrocarbons, oxides of nitrogen and carbon dioxide, and secondary pollutants such as ozone, a photochemical oxidant. In addition, diesel buses and cars with diesel engines emit 50 to 80 times more particulates than gasoline-fuelled vehicles.

Petroleum, natural gas, and coal are primarily made up of hydrocarbons, chemical structures containing hydrogen and carbon in various combinations. Other hydrocarbons such as benzene are added to fuel to enhance engine performance. When the fuel is vaporized by the internal combustion engine on cars, trucks or buses, pollutants are released into the air. Substances that are of concern to human health are described in Table IV.

Some gasoline additives, including benzene, methyl tertiary butyl ether (MTBE), polycyclic aromatic hydrocarbons (PAHs), toluene and xylene have been placed on a priority substance list in the Canadian Environmental Protection Act (CEPA) requiring thorough assessment and possible control.²⁰ Automobiles are reported to be the largest source of atmospheric benzene. Other pollutants of concern from transportation sources include aldehydes, methylcyclopentadienyl manganese tricarbonyl (MMT) and diesel particulates.

Automobile emissions of pollutants such as hydrocarbons, carbon monoxide and oxides of nitrogen have been reduced by over 40% in the past decade. This is due to legislation aimed at manufacturers, distributors and producers of fuels. Catalytic converters on automobiles and the discontinuation of lead in gasoline are the result of these initiatives.

This decrease in pollution generated per car is tempered by the increasing number of cars on the road today. The number of car trips in the Ottawa-Carleton and Outaouais Region rose by 12% in the past decade, with the number of trips per person per day increasing from 2.22 trips in 1976/77 to 2.63 in 1986.²¹

Table IV Substances of Health Concern in Automobile Emissions

SUBSTANCE	HEALTH CONCERN
Benzene: Improves gas burning, especially in winter months	Human carcinogen. Toxic to bone marrow. May cause anemia and leukemia.
MTBE (Methyl tertiary butyl ether): Octane enhancer to replace lead	Suspected chronic health effects still under investigation
Toluene: Octane enhancer	Toluene is suspected of causing neurological damage in humans as well as damage to the liver and kidneys
Xylene: Octane enhancer	Effects of exposure include respiratory irritation, gastrointestinal disturbances and narcotic effects, and have been associated with behavioral and central nervous system disorders in humans who work with these compounds
PAHs (Polycyclic aromatic hydrocarbons): Found in the particulate emissions from diesel engines	Some PAHs may be metabolized by the body into reactive teratogens and/or carcinogens
Aldehydes (eg. Formaldehyde): Produced by the incomplete combustion of gasoline (especially methanol fuels)	Suspected carcinogen and acute health effects at high concentrations
Diesel Particulates: Diesel exhaust	Concern about chronic lung disease and their contribution to cancer. Particles of respirable size are capable of deep penetration into the lungs. Carcinogens can be absorbed onto these particles.
MMT (Methylcyclopenta-diethyl manganese tricarbonyl): Octane enhancer	Neurotoxin

B.3.2 SPACE HEATING EMISSIONS

Space heating refers to the burning of fossil fuels in furnaces for heating commercial and residential buildings. Process heating refers to the use of furnaces such as steam-electric generating plants, industrial, commercial and institutional boilers to provide heat for manufacturing and production purposes. The emissions from space heating are described in Table V.

Table V Emissions from Various Types of Space Heating

Type of Space Heating	Significant Pollutants in Emissions
Oil Furnace	Sulphur dioxide
Natural Gas Furnace	Nitrogen dioxide
Wood Furnaces and Stoves	Heaviest particulate emitters
Common to All Forms of Space Heating	Carbon monoxide, carbon dioxide, particulates

Emissions from residential heating systems have improved in the past decade (See Section I.B.2.5 Sulphur Dioxide) with the help of "cleaner" heating oils and the increased popularity of natural gas for home heating. Natural gas is a cleaner fuel than oil, in terms of lower CO and SO₂ emissions. Many homes in the Region with oil heating are converting to natural gas, and approximately 95% of all new homes in the Ottawa area are built with natural gas heating systems.²²

Government offices and commercial space heating are also significant contributors of components of air pollution in the Ottawa area. The federal government alone has 12 large heating plants in the National Capital Region, and as many smaller ones.

B.3.3 OTHER LOCAL SOURCES OF AIR POLLUTION

There are a few secondary point sources of industrial and commercial air pollution in the Region. Examples of these pollutants include perchlorethylene (PERC) from dry cleaning operations; particulates that can contain heavy metals such as lead from automotive garages, auto body paint shops, and small foundries; and trace amounts of chemicals such as dioxins, polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs) from the few hospital incinerators.

These point sources discharge small amounts of pollutants that are a concern to human health. Dilution and dispersion of the limited quantities of these substances renders them virtually harmless because they are quickly diluted in the atmosphere. There is no routine monitoring of these point sources of air pollution. Certificates of Approval are issued by MOE for stationary sources of air emissions under the Environmental Protection Act. Problems are dealt with on a complaint basis by the Abatement Branch of the MOE, which ensures the conditions of the approval certificate are met. Control orders, stop orders and charges can be laid when contraventions are found. The MOE issues on average one or two orders a year to violators of the Environmental Protection Act. Two orders were issued by the MOE in 1990.

B.3.4 OUT-OF-REGION SOURCES OF AIR POLLUTION

Photochemical pollutants and the components of acid rain are continually transported into the Region from industrial centres in the north eastern United States and southern Ontario. Photochemical pollutants are formed by chemical reactions between reactive chemicals in the presence of sunlight. They are strong oxidizing agents, and include ozone, aldehydes and peroxyacylnitrates (PANs).

Another pollution source outside of the Region that affects our air quality is the pulp and paper mill in Thurso, Quebec, whose malodorous sulphur emissions are evident when wind conditions prevail from the east, and during temperature inversions.

B.4 INITIATIVES FOR IMPROVED OUTDOOR AIR QUALITY

Initiatives to address the Region's outdoor air quality concerns include all levels of government and the community. Most of the initiatives concern energy conservation or automobile emissions. This is because the burning of fossil fuels is the largest source of air pollution in urban centres.

B.4.1 FEDERAL INITIATIVES

The federal government has taken many steps to improve air quality in recent years, many of which are consolidated in Canada's Green Plan.²⁹ The Green Plan is a policy document released in December 1990, which outlines the federal government's initiatives to improve and protect the environment. Federal initiatives that are in place, or being implemented, include the following:

- 1) FEDERAL BOILER UPGRADING PROGRAM:** Heating plants that service federal buildings are being upgraded to reduce NO_x emissions by 1994. This program may have a significant impact because of the large number of federal offices in the Region. Once this has been accomplished, legislation will be introduced to require the private sector to improve its facilities.
- 2) THE MOTOR VEHICLE SAFETY ACT:** This act imposes emission standards on both light- and heavy-duty motor vehicles. These standards were upgraded in 1987 and 1988 to make them more stringent.
- 3) THE CANADIAN ROYAL COMMISSION ON LEAD IN THE ENVIRONMENT:** This commission studied the problem of lead additives in gasoline and resulted in the phase-out of leaded gasoline for commercial use by 1991. This action has significantly reduced the amount of lead in the environment, especially in urban communities (See Section I.B.2.6 Particulate Lead).
- 4) THE MONTREAL PROTOCOL:** The Montreal Protocol was an international agreement signed in 1987, aimed at controlling chlorofluorocarbons and other substances that deplete the earth's ozone layer.
- 5) CANADIAN ENVIRONMENTAL PROTECTION ACT:** The introduction of the Canadian Environmental Protection Act (CEPA) in 1988 set fines and jail terms for corporate polluters, and established a system for managing toxic chemicals through their development, production, transport, use, storage and disposal.
- 6) INTERNATIONAL PROTOCOLS:** Canada has agreed to several international protocols for the reduction or stabilization of air pollutants. Emissions of sulphur dioxide and oxides of nitrogen will be reduced by the year 1994 and levels of carbon dioxide and other greenhouse gases will be stabilized at 1990 levels by the year 2000.
- 7) THE FEDERAL/PROVINCIAL LONG-RANGE TRANSPORT OF AIR POLLUTANTS (LRTAP) STEERING COMMITTEE:** This committee was formed in 1988 to manage pollutants that are mobile over long distances and affect health and the environment, such as the components of acid rain and ozone.

8) BICYCLE PATH NETWORKS: The maintenance of an extensive bicycle path system on NCC property that is continually being improved and extended encourages people to use alternatives to motor vehicles.

B.4.2 PROVINCIAL INITIATIVES

The MOE is responsible for ensuring clean air in Ontario. It identifies sources of pollution and regulates the type and quantity of emissions permitted to be discharged into the atmosphere using Section 8 of the Environmental Protection Act of Ontario.

1) CLEAN AIR PROGRAM (CAP): The Clean Air Program (CAP) is a discussion paper released by the MOE in 1987 to present amendments to the Air Pollution General Regulation (O.Reg 308) under the Environmental Protection Act. Its purpose was to present the proposed changes for public comment.

The old regulation limited emissions to the environment on the basis of point-of-impingement effects after dispersion in the atmosphere. Much more has been learned about air pollution, its effects and methods of control since the last revision of the regulation in 1980.

The CAP paper identified problems with O.Reg 308 which needed attention, such as long-range transportation and deposition of pollutants, very short-term and very long-term effects of pollutants, and bioaccumulation, persistence, additive and synergistic effects of pollutants. Updating the regulation to establish specific requirements for treating emissions prior to their discharge from stacks, examining the use of air-quality models, and setting expiry dates for the approval certificates that are issued, were proposed in the CAP paper. To date the CAP proposal to amend O. Reg 308 has not been passed by the Ontario government, and its status is still a matter for discussion.

2) MONITORING: Ontario Regulation 296 sets out acceptable hourly, daily and annual average ambient air quality criteria for the previously described pollutants. The MOE operates the outdoor air monitoring stations in Ontario and has three mobile air monitoring units that are available to monitor complaints, emergencies, and carry out surveys on point sources of pollution such as industries. These mobile units help to identify contaminants and their sources.

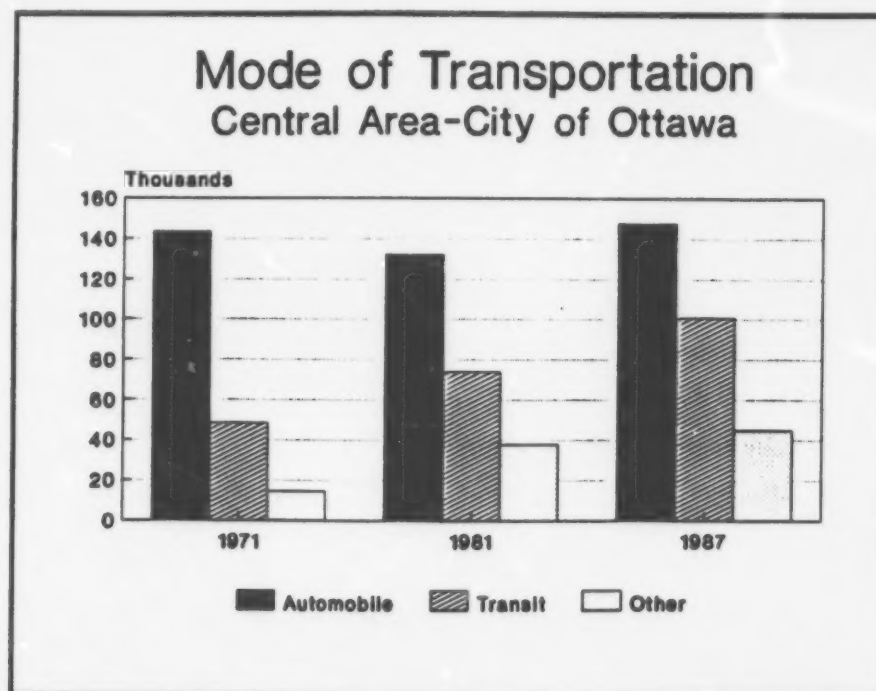
B.4.3 REGIONAL INITIATIVES

Efforts to reduce the number of vehicles on the road by providing good public transit and planning the growth of the Region with transportation in mind are two initiatives the Region is encouraging.

1) **PUBLIC TRANSIT:** O.C. Transpo services approximately 89% of the Regions' population with bus service in what is termed the urban transit area.²⁴ In recent years articulated buses have been replacing standard buses, resulting in larger passenger capacity per bus, and therefore fewer buses on the road per capita. There were 80 899 000 passengers using public transit in 1988, a 19% increase from 1979 levels.

Figure 15 illustrates the modes of transportation used to travel to the central business area for the years 1971, 1981, and 1988. There is a steady increase in the popularity of public transit but this gain has not reduced the number of automobiles in the downtown core.²¹ Further initiatives are necessary to reduce air pollution from automobiles.

Figure 15 Mode of Transportation



2) **OFFICIAL PLAN:** The Regional official plan uses zoning by-laws to limit residential, commercial and industrial growth to areas already serviced by public transit. Where possible, new streets run east-west to maximize the use of solar energy, through both active and passive systems.

C. INDOOR AIR

Because Canadians spend between 70-95% of our time indoors, indoor air quality is an important environmental health concern. Its effects are not always obvious. Our reactions to poor indoor air quality may be subtle, and awareness of its effect on us has only recently been acknowledged. Acceptable indoor air quality is defined as air with no known contaminants at harmful concentrations and with which a substantial majority of the people exposed (80% or more) do not express dissatisfaction.²⁵

The advent of the energy crisis in the 1970s had a great impact on indoor air quality. Private and public buildings were sealed and fresh air inputs were limited as part of energy conservation practices. Office buildings, including those of the federal government, were designed to follow these principles of energy efficiency. This reduction in fresh air turnover decreased the quality of air and resulted in many health complaints by inhabitants and workers. Relatively innocuous gases such as carbon dioxide became problems as a result.

C.1. INDOOR AIR CONTAMINANTS

The most common indoor air contaminants include carbon monoxide, carbon dioxide, radon, volatile organic compounds (VOC), particulates, nitrogen oxides and microorganisms.

C.1.1 CARBON MONOXIDE

Carbon monoxide in indoor air comes from gas, oil and wood heating and cooking appliances, tobacco smoke, and the infiltration of polluted outdoor air.²⁶ Carbon monoxide concentrations are often higher in homes than in public buildings. Exceptions are buildings where there is heavy smoking, offices with underground parking garages, and improperly designed or operating heating, ventilation and air-conditioning systems.²⁷ Arenas may also have high levels of carbon monoxide from the exhaust of ice cleaning equipment.

Excess carbon monoxide reduces the blood's oxygen content. Oxygen is transported through the body by the red blood cell. Because red blood cells' affinity for carbon monoxide is much higher than for oxygen, available oxygen is reduced in the presence of carbon monoxide.²⁷ Oxygen starvation causes visual disturbances, cyanosis, mental confusion, angina, coma and eventually death.²⁸ Chronic low-level exposure causes headache, nausea, breathlessness, dizziness and fatigue. Long-term, chronic exposure is hard to diagnose; the cardiovascular system could be affected.²⁷

A person who lives in a rural area and does not smoke has 0.5 to 0.8% carboxyhemoglobin in the blood.²⁷ An urban non-smoker has 1.0 to 1.5%, while a pack-a-day smoker has levels of 4 to 5%. Carbon monoxide has adverse effects on patients with cardiovascular disease, and can impair ability to concentrate.

Statistics Canada reported 238 deaths from carbon monoxide poisoning (due to incomplete combustion of domestic fuels) in Canada between 1973 and 1981. Groups at higher risk from the effects of carbon monoxide include fetuses, babies, pregnant women, and those with cardiovascular, cerebrovascular and peripheral vascular diseases.²⁸

C.1.2 CARBON DIOXIDE

Carbon dioxide (CO_2) in indoor air is a natural product of human metabolism and has no toxic effect below 15 000 ppm.²⁷ Exposure to very high levels ($> 50\ 000$ ppm) over several days produces headache, dizziness and visual distortions.²⁸ CO_2 is widely used as an indicator of indoor air quality because it indicates a lack of fresh air or an inadequate ventilation system. Levels over 1000 ppm indicate insufficient fresh air; a level of less than 600 ppm is considered ideal. Excess carbon dioxide levels are easily solved by increasing the quantity of fresh (unpolluted) outdoor air.

C.1.3 RADON

Radon is a colourless, odourless radioactive gas that occurs naturally where there are uranium deposits. In the open air, radon gas is diluted and poses no threat to health. In confined spaces, concentrated radon gas can be a health hazard. Radon seeps into buildings through dirt floors, cracks in the floors and walls, sumps, drains, concrete block walls and well water. It is also present in building materials such as concrete and stone if these come from areas with naturally high levels of radioactive minerals such as uranium.

Concentrations of radon are highest in basements which are poorly ventilated. Health and Welfare Canada guidelines propose 800 becquerels per cubic metre (Bq/m^3) or 20 picocuries per litre (pCi/L) as an acceptable upper limit for radon gas levels in homes.

Radon is linked to lung cancer in uranium miners who are exposed to levels many times greater than those found in homes. A federal study under way in Winnipeg is studying the health effects of low-level radon in homes. Some experts believe that long-term exposure to radon gas is the second greatest cause of lung cancer after tobacco smoke.²⁹

The Ottawa-Carleton Region has a variety of geological formations, some which contain high levels of uranium.³⁰ A sandstone formation located in Kanata that is approximately 25 km long and 2 km wide is one of the largest deposits of uranium in the Region. Other pockets of radon are located randomly throughout the Region, making no one location more of a hazard for radon gas than any other. Studies of homes in the Ottawa-Carleton area have found few homes with radon levels over the 800 Bq/m^3 limit. Home radon testing kits are available from the Health Department and other commercial outlets.

C.1.4 VOLATILE ORGANIC COMPOUNDS

Commercial solvents are the most common source of organic compounds in indoor air. Other sources include adhesives, paints, photocopy machines, tobacco smoke, aerosol sprays, cleaning and cooking products, hobbies and crafts, and human metabolic activity. In a study of 42 commonly used building materials, 22 organic compounds on average were emitted by each building material.²⁷ Materials contributing most of the solvent vapours and gases in the air include: various glues, floor textile, polystyrene foam, isocyanate varnish, PVC floor covering, sealing agent, acryllatex paint, and rubber floor covering.

Chlorinated organics are absorbed into the body by inhalation, through the skin and gastrointestinal tract. They tend to accumulate in fatty tissues such as the brain, bone marrow and body fat.²⁸

Short-term exposure can cause headaches, dizziness, upper respiratory tract irritation and nausea.²⁸ Recovery from the acute effects of exposure to the volatile chlorinated hydrocarbons is usually complete, but repeated exposure can permanently damage the central nervous system, cause eye and lung irritation and damage the skin, liver and kidneys.²⁸ There is little conclusive information on the effects of long-term exposure to many of these organic compounds.

Formaldehyde is the most common volatile organic compound in indoor air. It is a colourless gas with a sharp, pungent odour at elevated levels. It is widely used in construction materials, carpet adhesives and formaldehyde-based glues. It is a particular concern in homes due to its past use in the form of urea formaldehyde foam insulation (UFFI). Health concerns about UFFI were raised in the early 1970s, as it became evident that formaldehyde was released into the air when UFFI materials broke down, and during the burning of wood in fireplaces and wood stoves which releases formaldehyde from wood. Formaldehyde is absorbed by porous surfaces and textiles such as carpets and curtains, lingering in indoor environments for extended periods.²⁸ UFFI was banned as an insulation material by Health and Welfare Canada in April 1981. The Federal Department of Corporate and Consumer Affairs operated a grant program to assist homeowners remove UFFI from their homes between 1981 and 1986. In Ontario, 22 977 homeowners registered for this program, and 21 025 completed the work and collected the grant monies.

Both acute and chronic effects are associated with formaldehyde exposure. Acute reactions include headaches, stinging eyes and strong allergic reactions in some individuals. Formaldehyde is carcinogenic to some strains of rats, and weakly mutagenic in cultured human cells. Many questions remain about the chronic effects of exposure to formaldehyde in human populations, including its potential to cause cancer, permanently damage the respiratory tract and cause neurobehavioural impairment.²¹

C.1.5 PARTICULATES

Indoor particulate matter differs from outdoor particulate matter in two important ways. First, indoor particulate tends to be finer particles from combustion appliances and smoking, rather than the coarser particles found outdoors.²⁶ Finer particles are inhaled farther into the thoracic region of the lung, where they lodge and can cause more damage. Secondly, indoor air particulate matter contains a higher fraction of organic matter from cooking and cleaning activities.²⁶

High levels of indoor particulates can cause respiratory problems. Dust, pollen, mites and fungal spores can aggravate allergies. Cigarette smoke is the most significant indoor source of particulate matter, and resident smokers can raise levels of fine particles significantly.²⁶ Over 2000 chemicals and particles are found in cigarette smoke. Fifty of these are known to cause adverse health effects²⁶ and twelve are known or suspected carcinogens. It is estimated that 86% of non smokers are regularly exposed to tobacco smoke either at home, at work or both.²⁸

Asbestos fibres are a serious health concern. Airborne asbestos fibres, with their unique needle-like form, easily find their way into our lungs and gastro-intestinal systems, where they penetrate tissues and cause lung cancer, asbestosis, mesothelioma and possibly gastrointestinal cancer.²⁸ Asbestos will even travel from work sites to the home on contaminated clothing. There is no safe level for asbestos exposure and small exposures can cause illness 20 or 40 years afterwards.

Asbestos may be present in residential, commercial and industrial environments and must be treated with extreme caution. It is a good fire retardant and insulator and, prior to 1980, was used widely. It is still used in some industrial applications. It may be in the form of ceiling and floor tiles, pipe insulation, sprayed insulation (banned in 1973), caulk and filler, and brake linings. Originally fixed safely in materials, asbestos fibres are released when the materials are worn, damaged or disturbed.

Because there is a high risk to workers removing the material and because it is difficult to decontaminate areas after removal, the Royal Commission on Asbestos concluded that it is often safer to leave asbestos in place than to remove it. Deteriorating asbestos is contained or encapsulated wherever possible.

The Ontario Ministry of Labour requires all school boards to have an asbestos management program, under Ontario Regulation 654/85. This regulation ensures that a full inventory, proper monitoring and appropriate steps are taken when asbestos is found in schools. Boards of education in the Region all have asbestos management policies in place.

C.1.6 NITROGEN OXIDES

Nitric oxide (NO) and nitrogen dioxide (NO₂) are introduced to indoor air as by-products of combustion from gas stoves and fireplaces, kerosene heaters and diesel engines, and from tobacco smoke.²⁸ Nitrogen oxide alone is not irritating but its oxidized form, NO₂, can cause eye and upper respiratory tract irritations in low levels. Higher levels of NO₂ can produce chronic lung disease. Persons with chronic lung conditions are more susceptible to these effects.

C.1.7 MICROORGANISMS

The presence of moulds, mildew, fungus, bacteria and viruses in air is a function of the water vapour present in air. Water vapour is measured as relative humidity, which is the ratio of the concentration of water vapour present to the concentration needed to saturate air at that temperature. Indoor humidity is affected by outdoor humidity and temperature as well as by indoor vapour sources. Health problems can occur if humidity is either too low or too high.

Ideally, relative humidity in indoor air should be between 30 and 55% in the winter months.²⁶ Lower humidity causes dry skin and throat and sinus irritation, while higher levels promote the growth of microorganisms that can cause allergic reactions, odours and respiratory illnesses. Some moulds release mycotoxins which can cause serious health problems, and are still being studied. Bacterial and fungal survival rates increase substantially at high humidity, and dust mites thrive.

Common sources of microorganisms are human and animal occupants, house plants, minor plumbing leaks, and improperly installed insulation. Humidifiers are a source of microorganisms if not operated properly, as stagnant water provides an excellent medium for microbial growth. Ultrasonic humidifiers can increase the microbial risk by dispersing them. Drum humidifiers are more easily maintained.

C.2 COMMON INDOOR AIR PROBLEMS

"Sick building syndrome" (SBS) is used to describe indoor environment problems in both homes and workplaces. It has been attributed to numerous factors including inadequate supply of outside air, cigarette smoke, off-gassing of building materials, poor circulation of air, microorganisms breeding in and dispersed by humidifiers, and inadequate control of temperature and humidity. Other non-air factors that have been implicated include noise, artificial lighting, static electricity and psychological effects due to sealed or tinted windows, lack of privacy, stress and lack of control over indoor climate. It is likely that no single factor accounts for SBS.

The consequences of SBS are reduced work performance and increased absenteeism and even building closure. The symptoms associated with SBS are present in the population at large, but are more prevalent in some buildings than others. Several studies have examined the variety of symptoms in relation to common air pollutants and concluded that there is no difference in pollutant concentrations between "sick" and "non-sick" buildings.

SBS is not an isolated or unusual phenomenon. A World Health Organization (WHO) working group stated that although incidence varies from country to country, "up to 30% of new or re-modelled buildings may have an unusually high rate of complaints". One common factor in SBS buildings is they are all relatively new and air conditioned. Modern building materials and the off-gassing of chemicals such as formaldehyde could account for some of the differences between air conditioned and older, naturally ventilated buildings.

C.2.1 INDIVIDUAL SUSCEPTIBILITY

People who suffer from asthma, allergies, bronchitis, emphysema or who are otherwise susceptible to respiratory problems are more likely to suffer from exposure to various air pollutants. In addition people react to pollutants in different ways. Some people are more sensitive than others and some develop hypersensitivities and suffer severe reactions to very low levels of chemicals.

People who are this sensitive are said to suffer from environmental hypersensitivities. The prevalence and cause of hypersensitivities are still not well documented, though the symptoms are now well recognized. A working definition of environmental hypersensitivity suggested by Stigler *et al* is:

" A chronic, multisystem disorder caused by adverse reactions to environmental incitants, modified by individual susceptibility and specific adaptation.
The incitants are present in air, water, food, drugs and our habitat."³²

The Report of the Ad Hoc Committee on Environmental Hypersensitivity Disorders (1985) prepared for the Ontario Ministry of Health acknowledged the illness as a valid one. Exposure to gasoline fumes, cigarette smoke, perfumes, household cleaners or paints can trigger symptoms. The conditions may progress to serious illness and disability requiring the afflicted person to quit work or school. There is a small population that is sufficiently hypersensitive to low-level chemical and biological exposures to require specialized housing.³³

C.2.2 WORKPLACE ENVIRONMENTS

Industrial environments are not discussed in this report, as each industry is unique in terms of the contaminants generated. An extensive initiative, the workplace hazardous materials information system (WHIMIS) is a federally and provincially legislated program to improve workplace safety through increased availability of information on products in the workplace, and employer and employee education. The Occupational Health and Safety Act legislates amounts and protective apparatus required in these environments. The major causes of indoor air quality problems in workplace environments have been identified by air quality experts as inadequate ventilation (50-70% of cases investigated), contaminants inside the building, microbial contamination and contamination from building fabric.

Indoor air quality problems in the workplace are likely to increase. With its high percentage of indoor white collar workers, Ottawa-Carleton is expected to experience more than its share of SBS and indoor air quality problems, compared to other regions.

C.2.3 RESIDENTIAL ENVIRONMENTS

Common air problems in residential dwellings include high moisture, products of combustion, furnace backdrafting, off-gassing of construction materials and furnishings, and radon gas entering the building. Allergies, irritated mucous membranes and occasionally more serious health effects are the result of poor residential air quality. Two deaths in the Region were attributed to furnace flue gas accumulation in homes in the past year.

C.3 INDOOR AIR QUALITY STANDARDS

Industrial air quality standards are usually different from housing guidelines. They take into account the long-term effect of pollutants in housing, at usually lower concentrations.

C.3.1 WORKPLACE STANDARDS

Workplace air quality standards are governed by the Occupational Health and Safety Act set out by the Ontario Ministry of Labour (OMOL). Standards are given for time weighted average exposure criteria (TWAEC), short-term exposure criteria (STEC) and ceiling exposure criteria (CEC) to reflect the range of effects of different chemicals and biological agents on human health.

C.3.2 RESIDENTIAL GUIDELINES

Health and Welfare Canada has developed guidelines for exposure to indoor air pollutants in homes²⁶ (Table VI). The guidelines are given for both long- and short-term exposures. Short-term exposures are given for specific time periods, typically 24 hours. Long-term exposure rates are considered safe for continuous exposure over a lifetime.

Table VI Health and Welfare Guidelines for Indoor Air Quality

Pollutant	Acceptable Long Term Exposure (ALTER)	Acceptable Short Term Exposure (ASTER)
Formaldehyde*	0.05 ppm (parts per million)	Less than 0.1 ppm
Carbon Dioxide	3500 ppm	Less than 7000 ppm
Carbon Monoxide	None	Less than 11 ppm averaged over 8 hours Less than 25 ppm 1 hour average
Nitrogen Dioxide	Less than 0.052 ppm	Less than 0.25 ppm 1 hour average
Water Vapour	30-80% relative humidity (summer) 30-55% relative humidity (winter)	100%
Sulphur Dioxide	Less than 0.019 ppm	Less than 0.38 ppm 5 minute average

* For formaldehyde, guidelines specify a long-term "target level" rather than an ALTER and a short-term "action level" rather than an ASTER.

C.3.3 TESTING TECHNOLOGIES

Identifying and testing for indoor air problems can be a complicated and expensive task. Observation, common sense and experience are often the best guides. Testing methods used to measure concentrations of pollutants in indoor air include: time-averaged testing, spot testing and continuous monitoring.³⁴

1) TIME-AVERAGED TESTING: This testing gives the average pollutant levels. It involves taking a continuous series of readings and averaging them over time. Examples of this method include track-etch detectors for radon and formaldehyde "badge" detectors.

2) SPOT TESTING: This testing determines the peak levels of a pollutant. Testing is done when systems are in operation to produce the maximum pollutant levels.

3) CONTINUOUS MONITORING: Uses a continuous monitoring device to track levels over a period of time. An example is a hydrothermograph which measures temperature and humidity.

Testing of indoor air quality is usually done by the Ministry of Labour and by health and safety committees in workplaces; and by public health officials and consulting firms in private residences. As mentioned earlier, problems usually go undetected until adverse health effects occur, due to the subtle nature of the problem in most cases.

C.4 INITIATIVES FOR IMPROVED INDOOR AIR QUALITY

C.4.1 LEGISLATED RESTRICTIONS ON SMOKING

Legislation restricting smoking originates at the municipal, provincial and federal levels of government. The intent of these by-laws, regulations and acts is to protect non-smokers from second-hand tobacco smoke.

Cigarette smoking in enclosed areas increases particulate concentrations and gases, including carbon monoxide, nicotine, nitrosamines and benzopyrene. There is sufficient evidence indicating that prolonged exposure to tobacco smoke leads to a variety of health problems for non-smokers, and many reports show that second-hand smoke exacerbates symptoms of pre-existing conditions such as angina, acute respiratory diseases, chronic obstructive lung disease, asthma and allergies.³⁴ Common complaints of exposure to second-hand smoke include eye and nose irritation, and odours.

Epidemiological evidence also points to increased risk of lung cancer deaths for exposed non-smokers. In Canada, of the estimated 30 000 (1985) lung cancer deaths directly attributed to smoking, approximately 500 were non-smokers exposed to second-hand smoke in the workplace.³⁵

C.4.1.1 FEDERAL LEGISLATION

Federal legislation in the form of the Non-Smokers Health Act became law as of December 1989, followed by the Non-Smoker' Health Regulations in January 1990. This legislation applies to such employers as banks, radio and television stations, trucking and shipping firms, bus companies, airlines, trains, and the offices of the federal government and federal crown corporations.

The regulations require designated smoking areas be established, and set out space requirements for the various establishments, notices of smoking restrictions and schedules of fines for violations of the regulations.

C.4.1.2 PROVINCIAL LEGISLATION

In January 1990 the Ontario Ministry of Labour passed the Smoking in the Workplace Act. This act prohibits smoking in enclosed workplaces under provincial jurisdiction except in specifically designated smoking areas. These designated smoking areas cannot exceed 25% of the total space of the workplace.

The legislation applies to all workplaces subject to Ontario labour legislation. This means that most of the retail, commercial, manufacturing and mining operations, offices, hospital, social service agencies and educational institutions are obliged to comply.

C.4.1.3 MUNICIPAL LEGISLATION

Most municipalities in the Region have smoking by-laws that complement the provincial and federal legislation. The legislation applies to reception areas; elevators, escalators and stairways; service lines or counters; municipal offices, facilities and establishments; libraries; taxicabs; restaurants; and other places of public assembly. These by-laws differ for each municipality, therefore individual municipalities should be contacted for details. The Medical Officer of Health has asked area municipalities to restrict smoking in the public areas of shopping malls as well, due to the high levels of second-hand smoke in these areas.

The City of Ottawa is applying to the provincial government for permission to enhance the requirements contained in the Provincial Smoking in the Workplace Act. It would like to ban smoking in private workplaces, and eliminate designated smoking areas. A few municipalities in southern Ontario have enacted similar legislation. The City of Ottawa has recently amended its by-law to restrict smoking in restaurants with seating for more than 40 people. These restaurants must set aside 50% of floor space for non-smokers.

C.4.2 CONTROL MEASURES

Indoor air quality is a function of the design of enclosed spaces, of ventilation systems, the way systems are operated and maintained, the presence of contaminants and the strength of such sources.²⁵ The three principle methods of controlling problems of indoor air quality include ventilation, air cleaning and source elimination.

1) VENTILATION: The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) recommends 15 cubic feet per minute (cfm) per person (7.5 litres per second) of outdoor fresh air for most indoor environments. The Ontario Building Code was amended in October 1990 to reflect this change, and provide for a fresh air intake in all new buildings. The old standard of 5 cfm was the standard for most building construction. Some central heating and cooling systems are designed to control fresh air intake and can improve air-volume exchange. This dilutes pollutants. Being able to open windows provides fresh air and a sense of control which can alleviate the psychological factor. Control of natural ventilation in residences varies with weather conditions, construction and occupant activities, and is therefore very difficult to regulate. Home air conditioning systems (for example heat pumps) often have no provision for fresh air intake. Tightly insulated homes can have even worse air quality than commercial buildings and may require air exchangers or heat recovery ventilation systems.

2) AIR CLEANING: Particulate matter can be reduced by air cleaning devices which operate by filtration, adsorption, absorption and electrostatic precipitation. These devices are applied to exhaust air from the pollutant source, to recirculated air or to the air supply. Air-cleaning equipment can improve the quality of the outdoor air used as the fresh air source, as well as removing particulates generated in the building.

3) SOURCE ALTERATION: Many materials used in building construction are sources of indoor air pollution. Removal of these sources altogether is the best control method, however it is not practical in most instances. For people with hypersensitivities, this may be the only choice. Careful selection of building materials can reduce the presence of some pollutants. Furniture, carpets and other furnishings can also be selected with this in mind. Developers and home builders are also starting to pay closer

attention to the materials used in new structures.

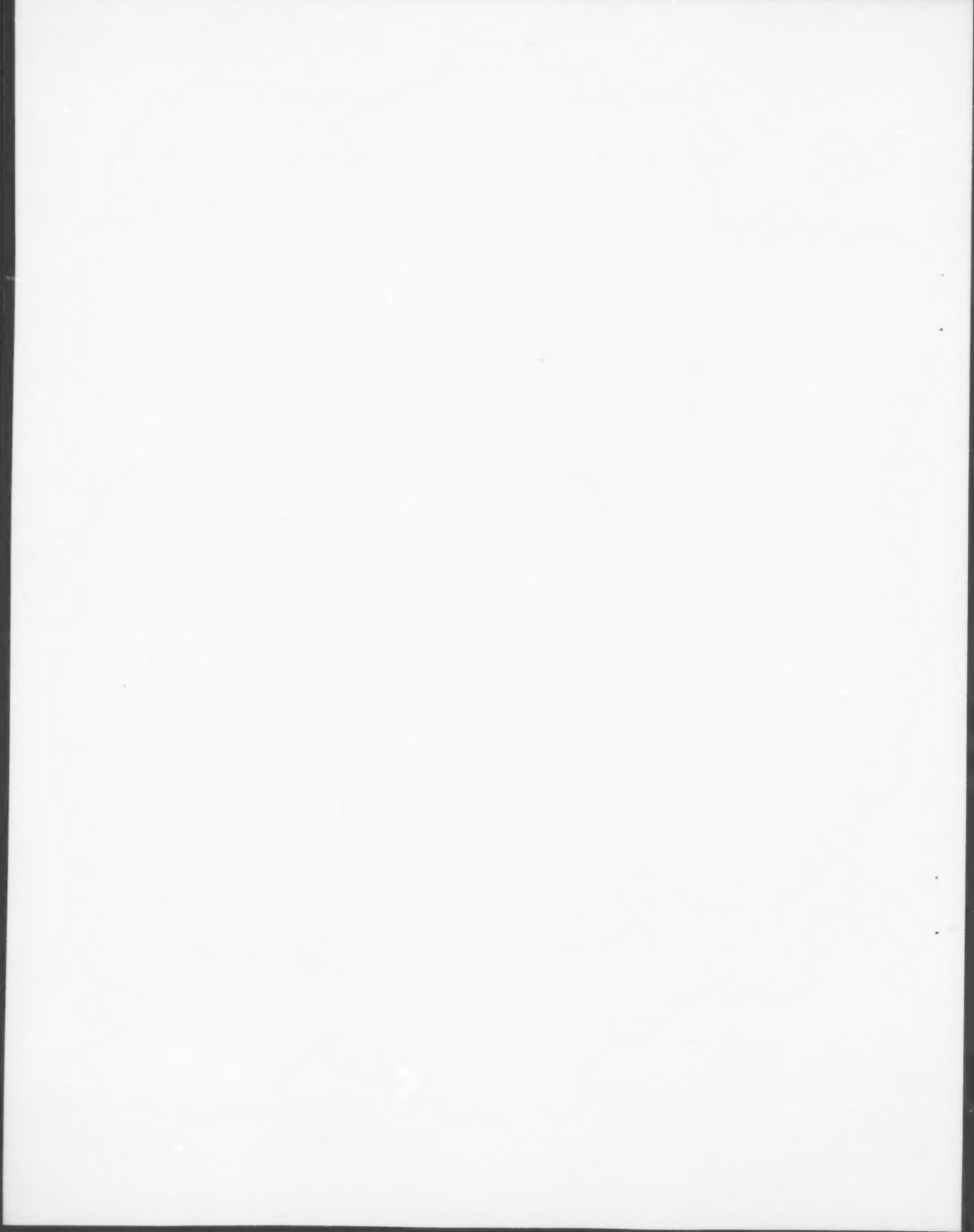
Remedial action to reduce the radon levels in a building is usually achieved by sealing cracks and other points of radon entry, installing self-sealing floor drains, by improving ventilation in basements and/or removing materials that are high in radium. Canada Mortgage and Housing Corporation has published a "Guide to Radon Control" for homeowners which details these techniques. Because homeowners can inadvertently increase radon levels in their attempts to solve this problem, it is important to consult such a guide.

C.4.3 MONITORING AND DETECTION OF PROBLEMS

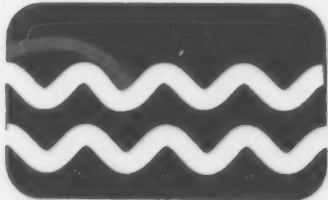
The Regional Health Department and OMOL investigate indoor air quality on a complaint basis. When an air quality problem is suspected, monitoring and investigation is carried out. Common problems include carbon dioxide, formaldehyde and ozone.

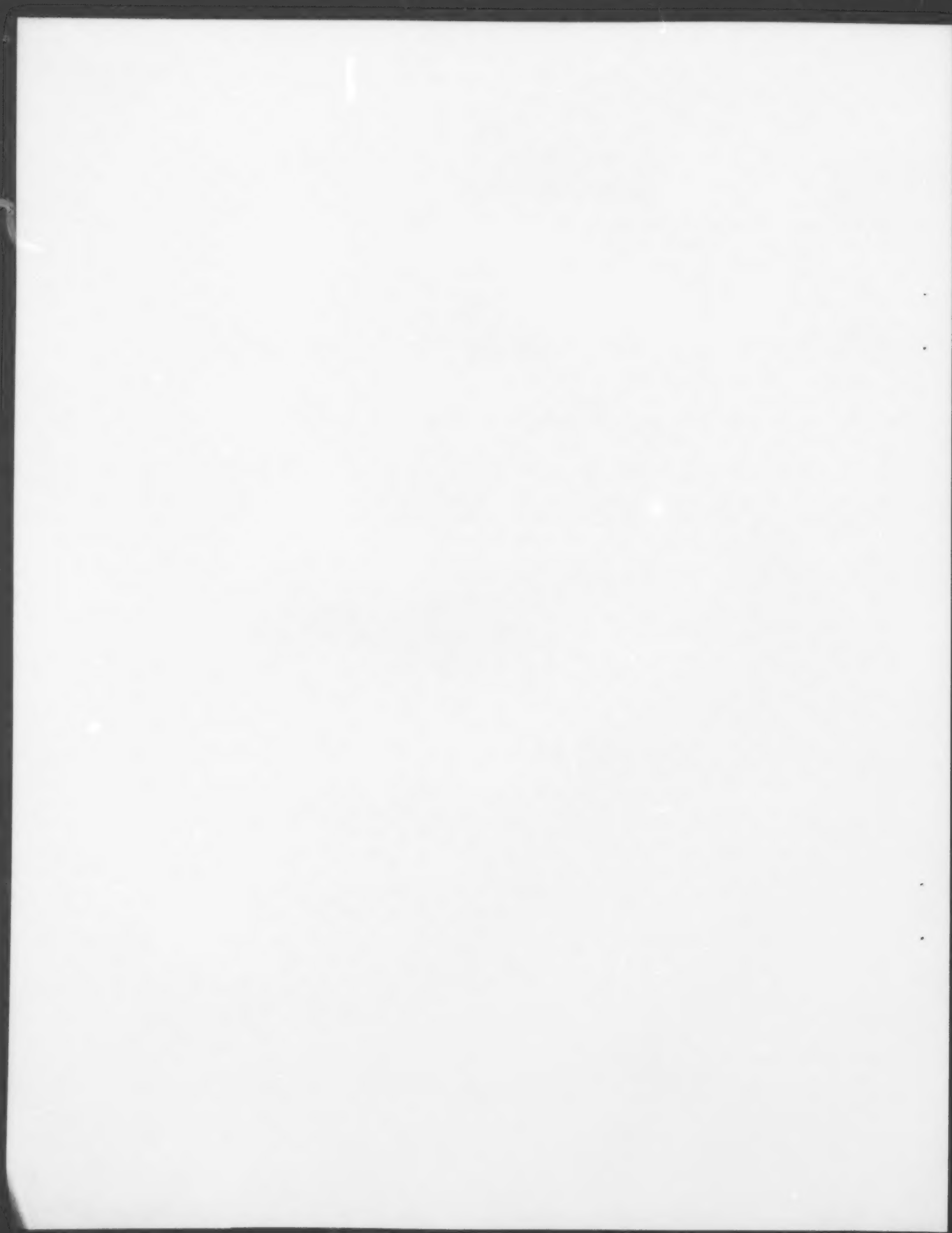
C.4.4 RESEARCH

The health effects of indoor air pollution on health have been investigated with increasing intensity since the early 1970s. Present knowledge about the most serious effects of long-term exposure to indoor air pollutants is based on large surveys and clinical studies. While clinical studies have identified important short-term reactions to exposure, more information is needed on long-term exposure to low-level pollutants. The combined effect of indoor air pollutants is also not well understood.





WATER 



A. INTRODUCTION

Water is the source of life here on planet Earth, and water quality is the most fundamental public health responsibility. When water is contaminated, the very fabric of a society is affected: infant mortality increases; water-borne diseases such as cholera threaten the population; and every energy is directed to rectifying the problem.

Here in Ottawa-Carleton, the Regional water supply is clean and safe; recreational water is regularly tested and the population informed of the results; and bacterial testing of ground-water for rural residents is readily available free of charge.

That said, some common concerns remain. Bacterial contamination and a limited water supply are problems for some well users. Trace amounts of chemicals are present in treated water, and we must take precautions to ensure that these do not become a health hazard. Recreational waters are under pressure from pollution, and their resulting decline in oxygen levels and higher bacterial counts is evident in the increased algae blooms, fewer sport fish and more frequent beach closures.

The following report on water quality discusses drinking and recreational water quality in terms of health parameters, sources of contamination and initiatives for improved water quality. Drinking water, both from ground-water sources and the Regional source is examined in terms of microbiological, chemical and radiological parameters. Recreational water reporting considers beaches and consumption of fish from area waters.

B. DRINKING WATER

The Ottawa River provides drinking water for approximately 90% of the Region's residents. The river is a relatively clean water source due to its large size and the lack of extensive industry in its upper reaches and tributaries. It is the largest local body of water, and is best able to meet our drinking water requirements. The remaining 10% of residents who are not serviced by the Regional water supply use either private wells or communal wells. Some residents rely on bottled drinking water, but this is usually by choice and not by necessity. The Regional Health Department provides information and advice to residents who are concerned about bacterial or chemical water quality, either in the Regional supply or in private supplies.

B.1 DRINKING WATER STANDARDS

Drinking water standards are set by the federal and provincial governments. The Canadian Drinking Water Quality Guidelines* (CDWG) set out maximum acceptable concentrations and/or aesthetic objectives for physical, microbiological, chemical and radiological content. These guidelines are reviewed regularly by a national committee of experts and are updated as new information becomes available.

The Ontario Drinking Water Objectives (ODWO) are set by the Ontario Ministry of the Environment (MOE) based on the CDWG and guidelines from agencies such as the World Health Organization and the U.S. Environmental Protection Agency (US EPA). Both the CDWG and the ODWO apply only to treated communal water supplies. Private ground-water supplies do not necessarily meet all these guidelines but should be (and usually are) tested to ensure that they meet minimum safety standards. The responsibility to pursue a suspected problem in a private water supply rests with the owner.

The MOE has developed a draft policy for aesthetic parameters in private well water. The proposed policy sets acceptable ranges for chemical contaminants and recommends treatment for wells with marginal water quality, such as high sulphur or iron content. The MOE will use these guidelines in approving proposed subdivisions in the future.

The federal Food and Drug Act (Division 12) is currently the only standard applied to bottled water sold in Ontario. It sets microbiological standards and imposes minimal labelling requirements but does not restrict content in any way except to prohibit the addition of chemicals other than CO₂, ozone and fluoride.

B.2 REGIONAL WATER SUPPLY

The Regional Environmental Services Department is responsible for providing safe treated water supply for the Region. It operates two water treatment plants on the Ottawa River: Britannia Water Purification Plant and the Lemieux Island Treatment Plant. Each plant provides approximately half the water supplied to the Region, with Britannia servicing the west and Lemieux servicing the east.

These plants supply water to the cities of Gloucester, Kanata, Nepean, Ottawa, Vanier, the Village of Rockcliffe Park and parts of Cumberland and Goulbourn Townships. Recent expansion of the Britannia plant and planned expansion of the Lemieux plant over the next five years will provide water for expanding development.

B.2.1 DRINKING WATER TREATMENT

Ottawa River water has low total alkalinity and a high colour component due to past logging activities and the presence of decaying vegetation in the River. It undergoes multi-component treatment to disinfect it and remove impurities. The process involves pre-chlorination, coagulation, flocculation, sedimentation, filtration, post-chlorination, post lime feed and post fluoridation. Some residents supplement this process with their own water filters, which are usually activated carbon units.

Chemicals added to the Regional water supply during water treatment include:

- 1) Chlorine to eliminate microorganisms and algae.
- 2) Aluminum sulphate to assist in flocculation and sedimentation of suspended particles and colour.
- 3) Silica to assist in flocculation and sedimentation.
- 4) Slaked lime to increase alkalinity of the now soft water and help prevent corrosion.
- 5) Fluoride to help prevent tooth decay in the population.

B.2.2 MICROBIOLOGICAL QUALITY

Bacterial contamination of Regional drinking water is not a problem today because our water is treated with chlorine to remove all pathogens. As recently as 1912, 1378 people in Ottawa died of typhoid fever caused by a bacterium in the communal water supply called *Salmonella typhi*. The fever swept through the city of 87 062 twice between 1911 and 1913.³⁷

Disinfection at the Regional plants starts by chlorinating the raw water with doses that average 2.06 mg/L, and ends with another dose in the 1.0 to 1.5 mg/L range. Chlorine residuals of 0.5 to 0.8 mg/L are found at the tap.

Post-chlorination dosing has increased over the years from 0.5 mg/L in 1974, to 0.9 mg/L in 1981, to 1.5 mg/L in 1986. This increase is a response to expansion of the distribution system. To ensure water quality throughout the distribution system, and to prevent a resurgence of organisms at the far reaches of the system, the dosage has been increased. Consumers located close to the treatment plants may notice more of a chlorine taste and/or odour because of this increased dosage.

B.2.2.1 MICROBIAL TESTING

Standard bacteriological testing of drinking water examines samples for two types of bacteria: total coliforms and fecal coliforms. These bacteria are considered "indicators" of the presence of animal wastes and sewage. Coliform bacteria are always found in animal wastes and sewage, but are also found in soil and on vegetation. Fecal coliforms are only found in intestinal contents of warm-blooded animals and indicate recent contamination.

The Ontario Drinking Water Objectives (ODWO) state that there should be no total coliforms detectable per 100 mL of water. However, because coliforms are not uniformly distributed in water, and are subject to considerable variation in counting, the objectives provide that no more than 10 percent of community drinking water samples (based on a minimum of 10 samples) should show the presence of coliform organisms, and not more than one sample from a set of samples taken from the community on a given day should show the presence of coliform organisms. There are currently no viral standards for drinking water.

The Regional water supply is tested for indicator organisms on a daily basis both in water treatment plants and in the distribution system. Isolated incidents of bacterial contamination (total coliform) occur a few times a year in the distribution system, despite the fact that disinfection ensures no microorganisms are in the water when it leaves the plants. These incidents are rare, do not exceed the 10 percent criteria mentioned above (an average of 12 samples a year) and are corrected immediately. They have not resulted in any known adverse health effects.

B.2.3 CHEMICAL QUALITY

Chemicals in water are difficult to detect because they are usually present in small quantities. Treatment reduces the amounts of chemicals found in raw water but treatment and /or distribution can also add chemicals to the water. Chemicals such as lead are a concern because they affect our health if levels are too high. Other chemicals such as phenols are only of aesthetic concern because they affect the taste and smell of drinking water. Unpleasant tastes and smells can also occur from naturally decaying vegetation. Most taste and odour complaints are received during the spring and fall seasons when decaying vegetation is more prevalent. On occasion, discolouration can be due to maintenance work on the distribution system.

B.2.3.1 CHEMICAL TESTING

The MOE conducts two major testing programs on Regionally treated water: the Drinking Water Surveillance Program (DWSP) and the Trace Organics Testing Program.

B.2.3.1.1 DRINKING WATER SURVEILLANCE PROGRAM (DWSP)

The Drinking Water Surveillance Program (DWSP) tests bacterial, chemical and radiological parameters. (Appendix A). The program started in Ottawa in 1986, and tests raw and treated water throughout the supply and treatment system for up to 180 chemicals. These tests fall into five broad categories: inorganic and physical chemicals (pH, hardness), metals (iron, aluminum, arsenic), bacteria (coliforms, fecal coliforms), primary organics (chloro-organics, benzenes), and organic water (pesticides, herbicides).

B.2.3.1.2 TRACE ORGANICS TESTING PROGRAM

The Trace Organics Program was started in 1984 and tests raw and treated water samples from each water treatment plant approximately three to four times a year. Communal wells operated by the Region are also tested.

Each sample is tested for approximately 140 organic compounds. Forty-five of these are pesticides and herbicides. Testing is contracted out by Regional Environmental Services Department, and occasional testing by the MOE ensures quality control. Appendix B lists the compounds tested in this program.

B.2.3.2 HEALTH EFFECTS OF SELECTED CHEMICALS IN REGIONAL DRINKING WATER

Organic chemicals, sodium, aluminum and lead are chemicals of concern in treated drinking water supplies, and may be found in Regional water. However, according to the results from the Trace Organics and DWSP programs, no health-related guidelines for organic or inorganic parameters were exceeded in Regional drinking water from 1986 to 1990.

B.2.3.2.1 SODIUM

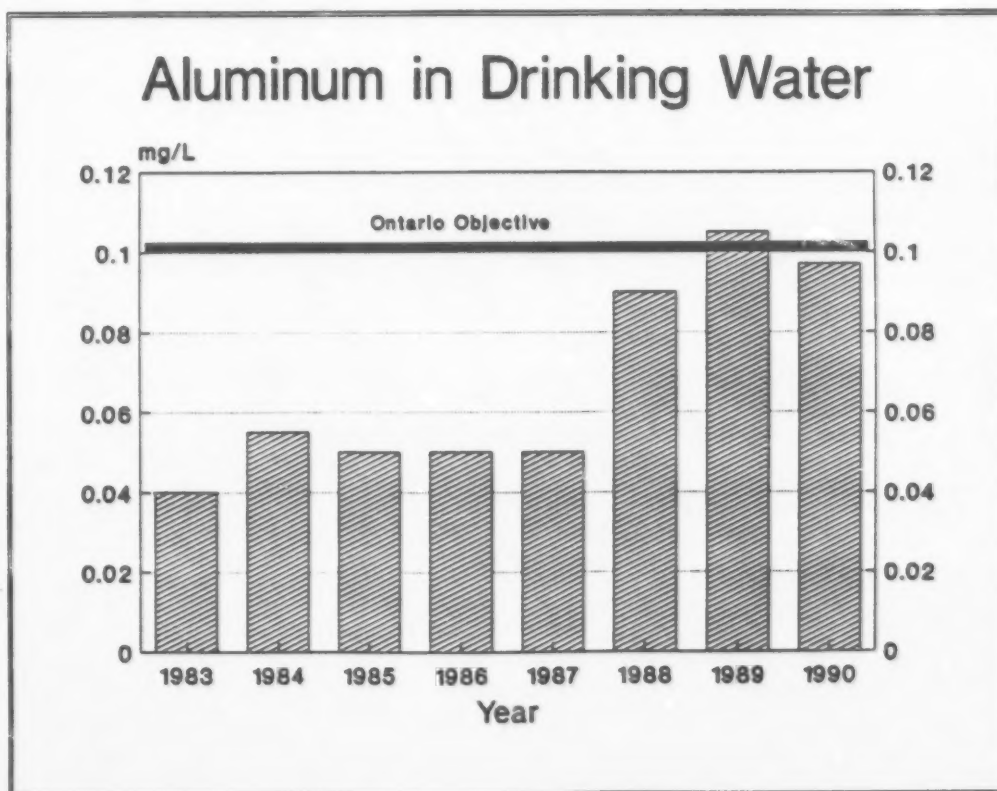
The average concentration of sodium in the Regional supply is 2 to 3 mg/L. This is well below the MOE objective of 20 mg/L for people on low-sodium diets. See Section II.3.3.2.1 for more information on sodium in drinking water.

B.2.3.2.2 ALUMINUM SULPHATE

Aluminum sulphate (alum) is used in water treatment to assist in coagulation of suspended solids and in colour removal. Aluminum is the third most abundant element on earth and has traditionally been considered inert. Humans receive most of their aluminum from food, and only 1% from drinking water.³⁸ Dietary intake of aluminum salts is estimated by the US EPA to be 20 mg per day. Because of possible links between aluminum and Alzheimer's disease, there is some concern about aluminum in drinking water. Research has not established aluminum as a cause of Alzheimer's disease or neurotoxicity although correlations have been suggested.³⁸ One study found the risk of Alzheimer's disease was 1.5 times higher in districts where the mean aluminum concentration exceeded 0.11 mg/L.³⁹

Annual average aluminum concentrations in the Region's drinking water have increased in the past six years, and range from 0.05 to 0.105 mg/L. Figure 16 illustrates annual average aluminum levels in Regional drinking water. Ontario Drinking Water Objectives (ODWO) specify a limit of 0.10 mg/L. This standard is not based on a scientifically established safe limit for humans.⁴¹ In 1989 Lemieux Island Treatment Plant exceeded this objective eight times, and the Britannia Plant six times. This may be due to improved testing techniques. The concentration of aluminum added to the water has remained at 32 mg/L over this time.

Figure 16 Annual Average Aluminum Levels in Regional Drinking Water



B.2.3.2.3 LEAD

Lead is a serious health concern at elevated levels. If too much lead is absorbed it can damage the brain, kidneys, nervous system and red blood cells. In the past century before the effects of lead were fully realized, many people died of lead poisoning from working with lead and the environmental fallout from industry. The concern with lead is no longer death by lead poisoning but the effects of smaller doses, insufficient to cause detectable signs and symptoms, but great enough to increase the body burden of lead. The classic effects of chronic lead poisoning include loss of appetite, metallic taste, constipation, anaemia, weakness, insomnia and headache.

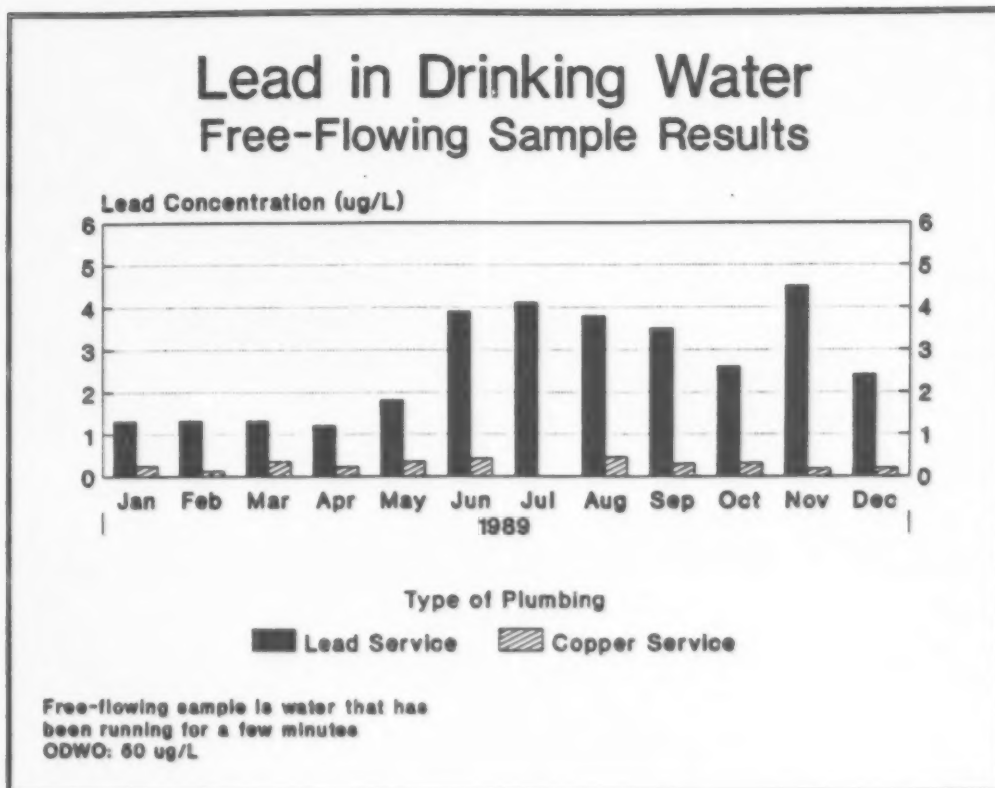
The greatest risk is to young children and pregnant women because it harms the developing brain and nervous system of fetuses and young children. Additional symptoms associated with blood lead levels in children over 10 $\mu\text{g/L}$ are decreased intelligence and slower neurobehavioral development. The largest source of lead contamination for the average member of the population in Ontario (those not exposed to local concentrations of lead) is food and water.

Drinking water can be a significant source of lead. The current standard is 0.5 mg/L lead in free-flowing water. Canadian tap water has 7.6 $\mu\text{g/L}$ of lead on average.³⁶ Lead is rarely present in raw water at any level of significance, nor is it present in water as a result of the water treatment process. It leaches into the water from lead pipes or lead solder in household pipes, especially if the water is acidic. Soft water corrodes pipes, causing higher levels of dissolved lead. The Ottawa River is considered to be soft, so its alkalinity is boosted to reduce corrosion.

Homes built before 1988 are more likely to have increased lead levels than newer homes. This lead can come from lead pipes or from lead solder. In the mid-1940s, lead pipe was largely replaced by copper pipe. In 1988, lead content in solder was limited to 0.02%. Even homes with lead pipes and/or lead solder do not necessarily have dangerous amounts of lead in the water. The RMOC Environmental Services department monitors lead levels in the Region on a monthly basis in two homes: one with lead pipes and one with copper. Water samples from these homes are tested for lead concentrations after sitting idle in the pipes overnight and after being flushed for a few minutes. The 1989 results from this survey are presented in Figure 17. Despite the fact that lead plumbing increases the lead substantially, levels are well below the CDWG limit of 50 $\mu\text{g/L}$. Lead levels are always highest when water has been stagnant in the pipes for several hours. Running the water for a few minutes will help reduce lead levels.

The Ottawa-Carleton Health Department has conducted other surveys of lead levels in drinking water in the Region in the past. Results consistently show that no matter how high lead levels are in stagnant water samples, running the taps for a few minutes always reduce the levels to well below levels which could cause any health effects. For this reason, taps should be flushed prior to use for drinking or cooking when water has sat idle in the pipes.

Figure 17 **Lead in Regional Drinking Water: Free Flowing Sample Comparison Between a Home With Lead and A Home With Copper Plumbing**



B.2.3.2.4 TRACE ORGANICS

The most commonly detected trace organics are trihalomethanes (THMs) and phthalates. Pesticides have been detected in trace amounts in drinking water in the past. Four pesticides were detected in 1990 in both raw and finished waters. Pesticide levels were well below any established health standards.

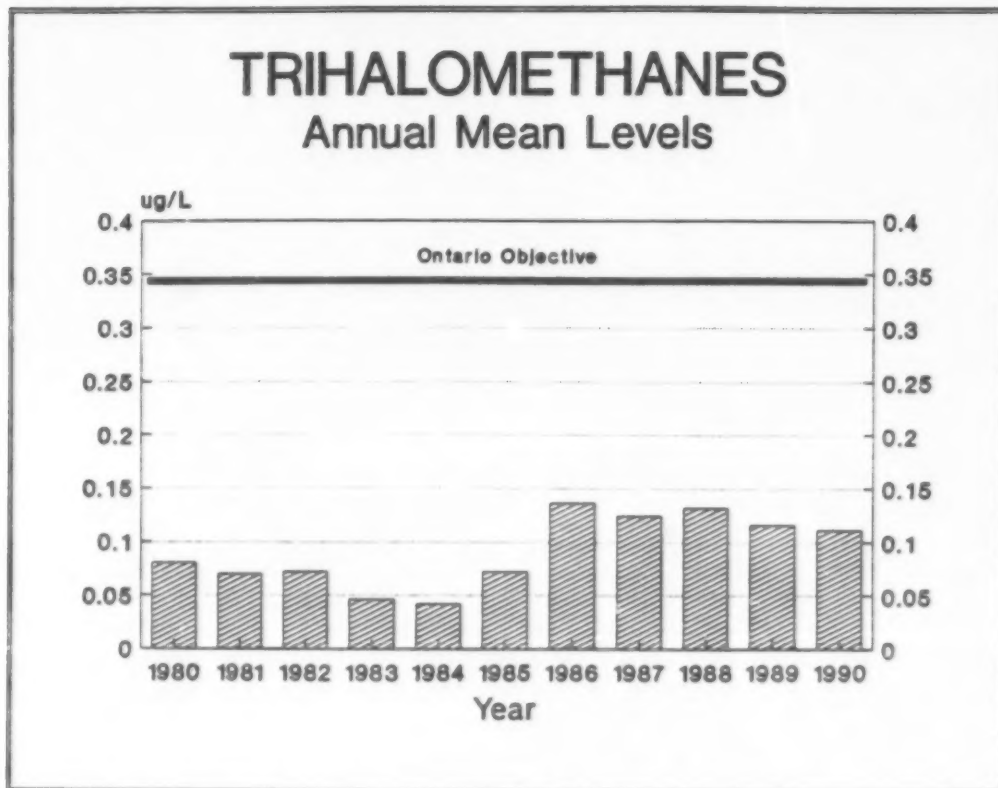
1) **TRISHALOMETHANES:** Trihalomethanes (THMs) are always present in the Regional drinking supply at some level, because they are a by-product of the disinfection process. They are formed when the chlorine used to disinfect the raw water combines with natural organic substances such as decomposed vegetation in the water. The most common THMs found are chloroform, bromodichloromethane, dibromochloromethane and bromoform. Chloroform is carcinogenic in animals.⁴⁰ Toxicological evaluation of THMs and their interactions is still incomplete.

THM levels in the Regional water supply are tested four times a year under the Trace Organics Testing Program and once a month under the DWSP. Figure 18 shows that the average annual THM levels are well within the Canadian standard and that no samples have ever exceeded the 0.35 mg/L maximum. The highest THM reading obtained in recent years in Regional water was 0.258 mg/L in 1988.

Canadian guidelines state that THM levels in "all samples" should be below 0.35 mg/L, while U.S. standards require the "average of all samples" to be below 0.10 mg/L. It is easier for U.S. water treatment plants to comply with their objective of 0.10 mg/L because they consider the annual average of all samples, whereas in Canada each sample must meet the 0.35 mg/L guideline. A federal-provincial committee on water standards has proposed cutting the allowable level of THMs to 0.05 mg/L in Canada, while the US is considering lowering its standard to 0.03 mg/L.

Ottawa-Carleton has higher THM levels than most Ontario communities. For example, Toronto averaged 0.020 to 0.025 mg/L during 1986 and 1987.⁴¹ Our higher THM levels likely result from the high quantity of organic impurities in the raw water supply and the increasingly higher post-chlorination residuals maintained by the Region. Alternative drinking water treatments are being considered and are discussed in Section II.B.2.5.

Figure 18 Annual Average THM Levels in Regional Water



2) **PHTHALATES:** Phthalate esters are colourless, odourless, oily liquids. These organic chemicals are used for a variety of purposes, including the manufacture of plastics and pump fluids, paints, insecticides and cosmetics. They are commonly found in drinking water sources that are also used for waste water disposal.⁴⁶ Studies on mice and rats indicate that some of the phthalates are suspected carcinogen promoters and are responsible for an increase in tumours.⁴⁶ Others are known to interfere with reproduction and are teratogenic (substances that produce abnormalities such as congenital malformations and spontaneous abortions). Trace amounts are detected periodically in water samples at the microgram per litre level. Concentrations are much lower than any assessed health standards, however standards vary greatly.

B.2.4 RADIOLOGICAL QUALITY

The Chalk River Nuclear Power Plant is located upstream of Ottawa-Carleton on the Ottawa River. It is operated as a research station and is not a public energy supplier. Nevertheless the potential for radionuclide contamination of water exists. The Bureau of Radiation and Medical Devices at Health and Welfare Canada has tested the water above and below the nuclear installations at Chalk River since the 1960s.

The radionuclides that contribute to radioactivity in water are cesium₁₃₇, iodine₁₃₁, radium₂₂₆, strontium₉₀ and tritium. CDWG for these compounds vary from 40 000 becquerels per litre (Bq/L) for tritium to 1 Bq/L for radium₂₂₆. The Regional water supply is monitored for these radionuclides biweekly. Trace amounts of Cesium₁₃₇ and Strontium₉₀ are detected in our drinking water. Their presence is largely attributed to global fall-out from weapons testing. Levels in the Regional water supply are well below CDWG^a, and have never exceeded objective levels since testing began in the 1960s despite some discharges of heavy water from the plant into the Ottawa River over the years. There have been three spills of heavy water from Chalk River in the past decade (1981, 1988 and 1991). In the 1988 spill, tritium was detected at 200 Bq/L at Ottawa, well below the CDWG of 40 000 Bq/L.

B.2.5 INITIATIVES TO IMPROVE REGIONAL DRINKING WATER

1) PILOT TESTING OF ALTERNATIVE DRINKING WATER TREATMENTS: Britannia Water Purification Plant has been selected for a provincial pilot project to test alternative disinfection techniques and ways of improving water treatment. Planning is underway to accommodate alternative treatments. THM reduction, taste and odour problems and reducing sludge are the most important issues to be addressed. Disinfectant treatments to be tested include ozone, activated carbon filters, and the use of chloramines for final disinfection.

Ozonation is a very effective disinfectant and is used in over 1000 drinking water plants in Europe. Its major disadvantage is instability. Ozone is very reactive and is suspected of reacting with organic chemicals to produce an array of by-products such as aldehydes. Because ozone leaves no residual in the water distribution system to control bacterial contamination, low levels of chlorine must still be added. This project should help address the relatively high levels of THM's in Ottawa-Carleton drinking water.

Activated carbon filters can improve the taste and smell of treated water supplies but the cost-effectiveness of large-scale application needs further study.

Another treatment to be tested is disinfection with chloramines, compounds combining ammonia and chlorine. These are weaker disinfectants than chlorine alone, but not as reactive as chlorine. Chloramines are best used after a stronger disinfectant has eliminated all microorganisms. Then they can be used to maintain residual disinfection in the distribution system. Chloramines are used in many treatment plants in the United States to reduce THMs in finished water.

2) POINT-OF-USE WATER TREATMENT DEVICES: Some residents choose to treat the Regional water with point-of-use water treatment devices. These devices can improve the quality of tap water by reducing THMs and other trace contaminants. The City of Toronto recently released a test of new activated-carbon and reverse-osmosis home-water-treatment units to determine removal of certain

chemicals and bacteria from a treated water supply. It found that trihalomethanes were reduced by more than 98%, and other chlorinated compounds such as chlorobenzenes were reduced by more than 80% with either device. Many polycyclic aromatic hydrocarbons (PAHs) were reduced by more than 90%. Toluene and xylene persisted after treatment by either device.⁴¹ Boiling water for 5 minutes also reduced THM levels by 98%. Consumers must treat home filters, especially charcoal models, with caution. Unless maintenance instructions are strictly followed, bacterial growth in the filter medium itself can contaminate drinking water. The use of point-of-use treatment devices is a personal choice, as the Regional water is not considered to pose any health risks.

3) FLUSHING TAPS AFTER EXTENDED PERIODS OF STAGNATION: After water has been sitting idle for hours, running taps for several minutes prior to drinking it flushes any lead which may have leached from the pipes and entered the water supply.

B.3. GROUND-WATER SUPPLIES

In Ottawa-Carleton approximately 66 740 people used private wells in 1990. This corresponds to 8.5% of occupied dwelling units and 10.3% of the residents in the Region. Problems differ depending on well depth and the quality of the aquifer. In areas where iron and sulphur are present in deep or drilled wells, some residents prefer using shallow or dug wells, despite the higher risk of bacterial contamination.

Most rural residents have private wells and some communities have common wells that service more than one household. The Regional government operates four communal wells, and ensures proper treatment and monitoring. These communal wells service residences as well as trailer parks, restaurants, marinas and campgrounds. The wells are located in Carp (Julia), Munster Hamlet, Manotick (Hillside Gardens) and Richmond (Kings Park). Private communal wells in Vars and Richmond are routinely inspected by the Regional government but are operated by others. Communal supplies not operated by the Region are monitored by the Regional Health Department to ensure safe drinking water.

B.3.1 WELL WATER TREATMENT

Most well water does not require any treatment to make it potable, provided the well is properly constructed and maintained. Well water disinfection and treatment is the responsibility of the home owner. Bacteria and some forms of chemical contamination require treatment before water is safe for human consumption.

Well water contaminated with microorganisms is treated with chlorine. Treatment for chemical contamination includes the use of water softeners for the removal of hardness, and filters for bad taste and odours. Heavy chemical contamination of water supplies such as high levels of inorganic salts can require the use of reverse-osmosis devices, or the search for an alternative water supply or aquifer.

Point-of-use water treatment devices (such as carbon filters) that attach to the tap have become popular for aesthetic problems in ground-water in recent years. While these devices can be useful for removing some chemicals, bacteria can accumulate on the filters, causing a health hazard. The extent of this problem in the Region is unknown. The manufacturer's maintenance instructions should be closely followed to reduce this risk.

B.3.2 MICROBIOLOGICAL QUALITY

The most common concern with well water is microbial contamination. Poorly constructed and maintained wells and poor quality water sources may be biologically contaminated by bacteria, viruses or parasites. This is especially a concern with dug wells which access shallow aquifers subject to surface contamination.

The presence of fecal coliforms indicates the presence of pathogenic organisms that may cause intestinal disease (such as shigellosis). Such water must not be consumed unless it is treated by prolonged boiling or chlorination.

B.3.2.1 TESTING

Private well water supplies can be tested by well owners or users. No sample should contain more than 10 total coliforms, none of which should be fecal coliforms, and no consecutive samples from the same site should show the presence of coliform organisms. This criteria is slightly different than the requirements for community drinking water supplies. Community supplies have large distribution systems and require many samples to be taken each day to ensure the safety of the supply reaching the consumer. The large number of samples required increases the potential of finding coliform bacteria present (See Section II.B.2.2.1). The Ontario Ministry of Health provides free testing of water for bacteriological contamination. Sampling bottles are available from the Ottawa-Carleton Health Department or the Ministry of Health Laboratories. We recommend that wells used for drinking water be tested twice annually and anytime a problem is suspected. The Health Department provides interpretation of the test results.

B.3.2.2 COMMUNITIES WITH BACTERIAL CONTAMINATION OF WELLS

Bacteriological contamination of wells is the most common problem in some small towns and villages in our Region. When problems became evident in the late 1970s and early 1980s, the Health Department and the MOE surveyed drinking water quality in many of these towns and villages to determine the extent of contamination. Bacteriological contamination of the wells could often be traced to problems with private septic systems.

Communities with contaminated wells include: Vars⁴³, Carp⁴⁴, Metcalfe⁴⁵ and Carlsbad Springs. Table VII summarizes the results of several MOE studies. Many of the individual problems have been identified and corrected through individual treatment, reconstruction or communal wells, or are currently being corrected.

Table VII Summary of Studies of Village Aquifer Contamination

Community	Year of Study	Problem Identified	Corrective Actions to Date
Vars Cumberland Twp.	1981	• 77% of dug wells & 29% of drilled wells bacteriologically unsuitable • 89% of dug wells & 73% of drilled wells chemically unsuitable	• Communal well system approved. • RMOC in final design stage of the communal well.
Carp West Carleton Twp.	1981	• 15% of wells suitable for drinking • 24% substandard • 37% seriously substandard • 24% unsuitable for drinking	• Communal well system approved. • RMOC in preliminary design stage of the communal well. • Connection to the Regional sewer system approved.
Metcalfe Osgoode Twp.	1984	• 34% of wells unsuitable for drinking	• a class environmental assessment under way to determine the best corrective action.
Carlsbad Springs Cumberland Twp.	1987	• 27% of wells safe for drinking • 15% doubtful water sources • 58% unsafe for drinking	• RMOC undertaking a preliminary assessment of corrective options available.

B.3.3 CHEMICAL QUALITY

Drilled wells use deep aquifers that are generally protected from surface contamination. Aquifers produce waters of different quality. It is generally acknowledged that the deeper a well is drilled in bedrock, the more likely it is to encounter water with problem chemicals. For example, iron and sulphur are common in drilled wells in Ottawa-Carleton. There are two categories of chemicals found in ground-water: health-related chemicals and aesthetic chemicals.

B.3.3.1 TESTING

Government testing of private ground-water supplies for chemical constituents is usually done when there is reason to believe a problem exists because of unusual smells or tastes in the water.

Communal ground-water supplies are tested regularly as part of the Regional mandate for testing water supplies that it operates. Testing for trace organics in the four communal wells operated by the Region started in 1988. Appendix A lists organic chemicals tested in communal wells under the Trace Organics Testing Program. Results from this testing are included in Section II.B.3.3.2.1.

The MOE requires developers to prepare and submit hydrogeological studies of the water supply for proposed developments such as subdivisions. These reports indicate the quantity of water available and levels of health-related factors such as sodium, fluoride, nitrate and turbidity, as well as aesthetic parameters such as pH, hardness, taste and odour, total dissolved solids, chloride, iron and manganese, to name a few. The MOE or the Health Department may request analysis for the presence of additional chemicals on proposed subdivisions if there is reason to believe a hazard could exist in the water supply. The final decision to permit development rests with the municipality, which reviews the recommendations made by agencies such as the MOE and the Regional Health Department. Small-scale land severances are not required to undertake similar chemical testing although most financial institutions require proof of water testing as a prerequisite for mortgages.

The MOE and the Regional Health Department also investigate possible contamination of water supplies at the request of physicians. Testing for background levels of fluoride and nitrates in ground-water supplies can be done through the Regional Health Department. If an individual wants to have well water tested for aesthetic parameters such as iron or sulphur, this will be done by a private laboratory or water treatment firm.

B.3.3.2 COMMON CHEMICALS IN GROUND-WATER SUPPLIES

Following are the most common chemicals of potential health and aesthetic concern. This is not a comprehensive list of chemicals found in area ground-water supplies.

B.3.3.2.1 HEALTH RELATED CHEMICALS

Health-related chemicals found in ground-water supplies include sodium, fluoride and nitrates. Organic chemicals may also be present. There is potential for contamination from lead in water distribution pipes for all homes, whatever they supply (See Section II.B.2.3.2.3). Organic chemicals such as pesticides are routinely tested in the four Regionally operated wells but not in private wells.

1) SODIUM: Sodium is a naturally occurring constituent of water and is very common in drilled wells in southeastern Ontario due to limestone and salt deposits. Water softeners to treat hardness in well water also increase sodium levels in well water. Sodium in drinking water is not a health concern for most people. However it may hinder compliance with low-sodium diets. The average adult intake of sodium (mainly from food) is 5656 mg/day.⁴⁶ Less than 1% of sodium intake normally comes from drinking water. For this reason there is no guideline for sodium in drinking water. The recommended sodium level in drinking water for people on low-sodium diets is 20 mg/L or less. People on low-sodium diets should discuss the sodium level of their drinking water with their physicians.

Occasionally shallow wells located along major highways in the Region are contaminated with road salt, and require well reconstruction or water treatment. Some regionally operated communal wells have elevated sodium levels in the range of 20 to 100 mg/L. Private area wells typically have sodium content in the range of 5 to 10 mg/L, but many have higher levels.

2) FLUORIDE: Like salt, fluoride is a naturally occurring constituent of ground-water. Some water in West-Carleton Township has naturally high fluoride concentrations. A deficiency of fluoride may be associated with an increase of dental caries and possibly osteoporosis, while too much fluoride can cause mottling of teeth and possibly osteosclerosis.⁴⁶ The U.S. EPA has proposed a recommended maximum Contaminant Level of 4.0 mg/L and operates under an interim maximum contaminant level of 1.4 - 2.4 mg/L. Levels between 1.0 and 1.5 mg/L are recommended concentrations in Canadian drinking water. Fluoride supplements are recommended for infants and children whose usual drinking water supply contains less than 1.0 mg/L fluoride.

3) NITRATES: High levels of nitrates in ground-water supplies are a health concern. Sources include septic system leachate and agricultural fertilizers and animal manure. This is predominantly a problem with shallow wells. Nitrates are dangerous because they are metabolized into nitrites in our bodies. Infants and young children are at special risk because their bodies readily convert nitrates into nitrites. Nitrites can cause methaemoglobinaemia (inability of the body to use oxygen) and have been identified as a possible cancer precursor.⁴⁶ Levels above the ODWO of 10 mg/L nitrogen have occasionally been found in ground-water supplies in the Region.

4) ORGANIC CHEMICALS: Testing for organic chemicals in Regionally operated communal wells since 1988 show levels to be well below the MOE objectives. Appendix A lists the 140 organic chemicals that make up the Trace Organics Testing Program in the Region. Bromoform, an organic chemical that is one of the trihalomethane group, was detected in the Giulia well water in 1989, but well below MOE objectives. For more information on trihalomethanes see Section II.B.2.3.2.4.

Trace amounts of pesticides were detected in the four Regionally operated wells at trace levels. Levels of pesticides were all below any recognized health standards.

B.3.3.2.2 AESTHETIC CHEMICALS

Many wells in Ottawa-Carleton have elevated levels of chemicals that cause aesthetic problems. These are naturally occurring and are due to our underlying soil formation. Bad tastes and smells are usually due to high levels of iron and sulphur in the aquifer. Hardness is caused by calcium and magnesium. These minerals do not normally present a health risk; in fact, hard water may be associated with decreased risk of heart disease. The Regional Health Department can provide information to those whose well water exceeds aesthetic guidelines.

1) **IRON AND SULPHUR:** Iron and sulphur are responsible for the majority of taste and odour problems in local well water. Iron concentrations above 0.3 mg/L and sulphate levels above 500 mg/L are considered aesthetically unpleasant and, in the case of sulphate, can have a laxative effect. Discolouration of fixtures is primarily due to iron.

2) **CALCIUM AND MAGNESIUM:** These minerals occur naturally in deep aquifers as calcium carbonate and magnesium carbonate. They precipitate in pipes, causing blockages, and reduce sudsing of soap and detergent, leaving a soapy residue in sinks and tubs. Water softeners reduce the hardness of water high in these minerals but should be by-passed for taps supplying drinking water.

B.3.4 SOURCES OF GROUND-WATER CONTAMINATION

Known pollution sources of ground-water in the Region are almost exclusively leachate from malfunctioning septic systems. This is primarily a problem when wells and septic systems are located close together, as in subdivisions and towns, where leachate can affect the drinking water of several homes. Malfunctioning septic systems exude bacteria and nitrates. As communities without Regional sewage and water services expand and grow to accommodate more residents, ground-water aquifers' capacity to provide safe drinking water is being reached.

There are many other potential sources of chemical contamination, including leaking underground gasoline storage tanks, leachate from active and inactive municipal and private dump sites, salt used on roadways, and fertilizers and pesticides used in agriculture. The extent of this type of contamination in the Region is largely unknown, but suspected to be quite low.

Ground-water quality and quantity will continue to be an issue for rural communities in the future. Careful planning and upgrading of septic systems and wells, and planning for Regional sewer and water services play an important role in ensuring the continued safety of ground-water supplies. The land section of this report discusses some of these sources of contamination.

B.3.5 INITIATIVES TO RESOLVE GROUND-WATER QUALITY PROBLEMS

Several agencies are looking into resolving current well water contamination problems, and preventing future problems with ground-water supplies.

1) COMMUNAL WELLS: New Regionally operated communal wells are under review in the communities of Vars, Carp, Metcalfe and Carlsbad Springs to resolve problems with bacterially contaminated wells. Many private developers are providing treated communal well water supplies to new housing developments.

The MOE Private Services Funding Program assists small communities with no growth in population that suffer from significant drinking water and/or sewage disposal problems. This program has been in place for over a decade and funds up to 85% of resolving contamination of private wells. Remedies vary depending on the nature and severity of the problem. The MOE also contributes up to 60% of the cost for small communities to upgrade communal water supplies, depending on the size of the population and the nature of the problem.

2) REGIONAL RURAL DEVELOPMENT STUDY: Rural development is a concern to area municipalities and the Region because of frequent requests to provide costly water and sewer services to villages wishing to expand. In 1990 Regional Council approved a study on the impact of rural development on ground-water supplies. This study will examine rural development in light of water quality and quantity, and will recommend locations and limits to be developed.

3) MONITORING OF SUSPECTED PROBLEMS: The MOE, and the Regional Departments of Health and Environmental Services undertake or contract studies when problems with drinking water supplies are suspected.

B.4 BOTTLED WATER

Canadians spend over \$100 million on bottled waters annually, consuming both still "spring" waters and sparkling mineral waters for their presumed health benefits. In fact, bottled water proves no more healthy than tap water in consumer testing, and some mineral waters contain harmful heavy metals, nitrates and excessive sodium. Bottled water quality may not be constant and even the leading brand of mineral water, Perrier, experienced a mysterious benzene contamination in 1990.

Bottled water is not subject to the same stringent standards as Regional tap water. The federal Food and Drug Act only requires bottlers to state the source of the water, the quantity of dissolved solids and fluoride content though most also state the percentage by volume of such ingredients as sodium, sulphates, lead and arsenic. One advantage of bottled water is that it is not treated or transported in lead pipes; this means it has fewer trihalomethanes and less lead than tap water.

Local bottlers of water conduct their own quality control tests and the Regional Health Department also routinely tests bottled water for total and fecal coliforms. Positive coliform findings are very rare and when problems are detected, a recall is immediately implemented.

B.4.1 INITIATIVES TO IMPROVE BOTTLED WATER QUALITY

Health and Welfare Canada is in the process of proposing guidelines covering the allowable level of contaminants in bottled water, similar to the CDWG which apply to tap water.⁴⁷ Currently bottled water is considered a food. The proposed initiatives would require bottled water to be subject to the same federal standards that apply to municipal supplies.

C. RECREATIONAL WATER

The watercourses in the Region are enjoyed for many recreational activities. Swimming, sailing, windsurfing, motor boating, paddling and fishing are all popular. Many of these activities are sensitive to pollution and the effect of water quality in the Ottawa, Rideau and Mississippi Rivers is a growing concern. The two most worrisome outcomes of recreational water pollution are increased bacterial levels and eutrophication of the rivers.

The Guidelines for Canadian Recreational Water Quality, published by Health and Welfare Canada, address health hazards in recreational waters. Specific contaminants that can cause health problems in recreational waters include: pathogenic bacteria such as *Pseudomonas*, *Salmonella*, *Shigella*, and *Staphylococcus*; viruses; the *Candida* yeast; nuisance conditions such as the schistosome organisms from snails, which cause "swimmers itch"; and aesthetic conditions such as floating debris, oil, scum, and turbidity. Skin rashes, ear and throat infections and gastro-intestinal illness can result from direct contact with polluted water.

Because they are smaller, more shallow and slower-flowing than the Ottawa River, the Rideau and Mississippi rivers are particularly susceptible to bacterial contamination and the growth of weeds and algae. Agricultural run-off and increased microorganisms and phosphates which tend to come with river-front development, all take their toll on these rivers.

C.1 RECREATIONAL USES

The three major recreational uses of Regional watercourses are swimming, boating and fishing. Passive enjoyment of natural areas is considered inherent in all aspects of recreational use.

C.1.1 BATHING BEACHES

The Ottawa-Carleton Health Department monitors public beaches in the Region to determine if they meet the Water Quality Guidelines for Bathing Beaches set out by the Ontario Ministry of Health. Beaches within the urban area are sampled six days a week, and beaches in rural areas once a week during the swimming season. Test results of rural beaches show consistently low bacterial levels.

During the summer months from May to August the Regional Health Department monitors 13 points on the Ottawa River and 17 points on the Rideau River. Figure 19 and Figure 20 show the sampling locations.

Figure 19 In-Town Sampling Locations on the Ottawa and Rideau Rivers

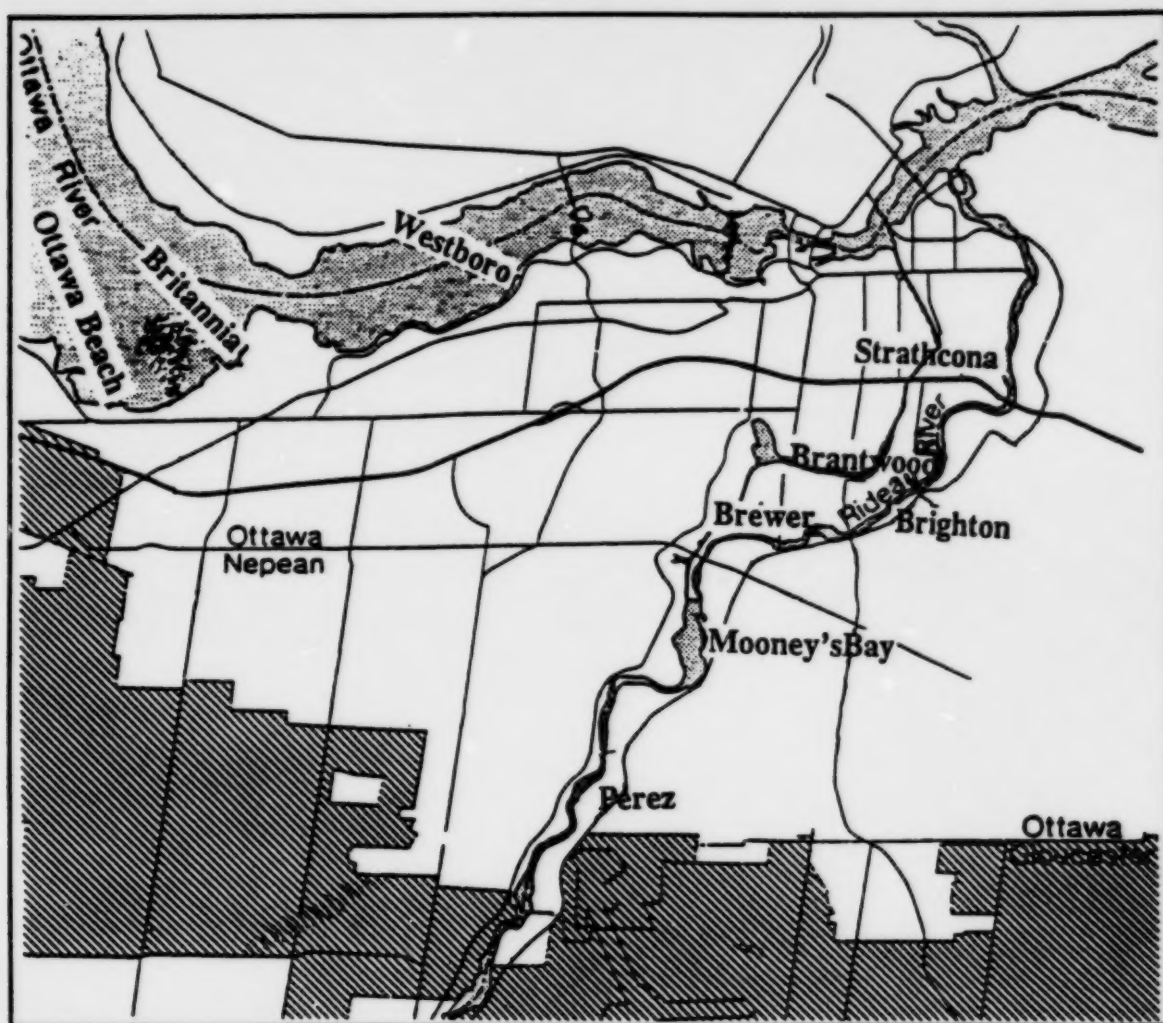
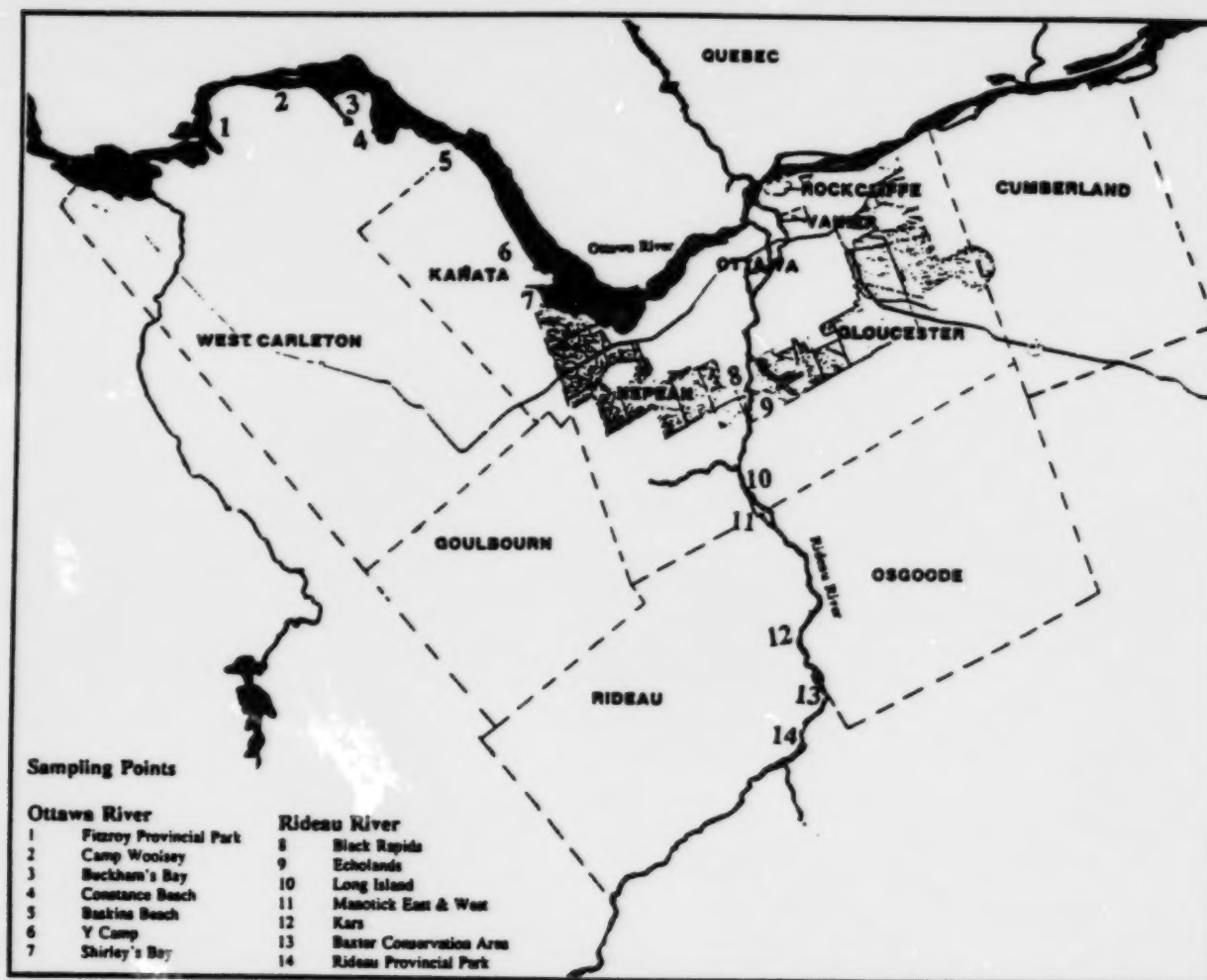


Figure 20 Out-of-Town Sampling Locations on the Ottawa and Rideau Rivers



C.1.1.1 GUIDELINES AND MONITORING OF BEACHES

The bacteriological guidelines set out by the MOE state that swimming is not recommended when the total coliform geometric mean exceeds 1000 per 100 mL of water, and/or the fecal coliform geometric mean exceeds 100 per 100 mL.⁴⁸ Currently fecal coliforms are the main indicator of beach pollution because they come from the intestinal tract of warm-blooded animals, and indicate fecal contamination. The growth characteristics of fecal coliforms are similar to that of disease-causing organisms, although more precise indicators are under review. Therefore the presence of fecal coliforms indicates a potential for health problems.

Brighton, Brantwood and Strathcona beaches on the Rideau River in the centre of Ottawa have been closed since 1970, and Brewer Park was only open for a short time in the 1970s before high bacteria levels resulted in closure. A beach known locally as "Ottawa Beach" adjacent to Andrew Haydon Park on the Ottawa River has also been closed for over a decade.

Based on these guidelines and monitoring, the Medical Officer of Health recommends keeping beaches open or not based on predicted health results. However the final decision is made by the municipality that maintains the facility.

C.1.1.2 INDICATORS OF POOR BEACH QUALITY

Surface water quality fluctuates greatly from day to day and even from hour to hour as the river flow constantly changes. Because analysis of water samples takes a minimum of 24 hours to culture in a laboratory, the Regional Health Department uses additional indicators to protect the public from unknowingly swimming in polluted waters.

In the early 1980s rainfall was used to determine when in-town beaches exceeded the Ontario objectives for safe swimming. Historical data indicated that bacterial levels were highest immediately following rainfall, due to surface water run-off. As the Region succeeded in eliminating sanitary waste discharges, and collector sewers were installed in Quebec, stormwater became the dominant source of pollution at the beach sites. For some years rainfall proved to be a reliable method of predicting pollution levels at our beaches. (Out-of-town beaches are not affected by surface run-off pollution to the same extent.)

However, over the years, tests on the Ottawa River showed fluctuating bacterial levels at Westboro and Britannia beaches that did not always correlate with rainfall. Identification of sources causing these high bacteria levels are ongoing. The Regional Environmental Services and Health departments are assessing more reliable pollution indicators than rainfall. These indicators include turbidity, wind velocity, air/water temperatures, number of bathers and time of sampling. Rainfall still helps predict poor water quality at the in-town beaches.

C.1.1.3 RURAL BEACHES

Over the past decade, there has been no serious deterioration of water quality on either the Ottawa or Rideau river rural beaches. There have been occasional incidences of high fecal coliform counts but no pattern of poor quality has been established.

C.1.1.4 URBAN AREA BEACHES

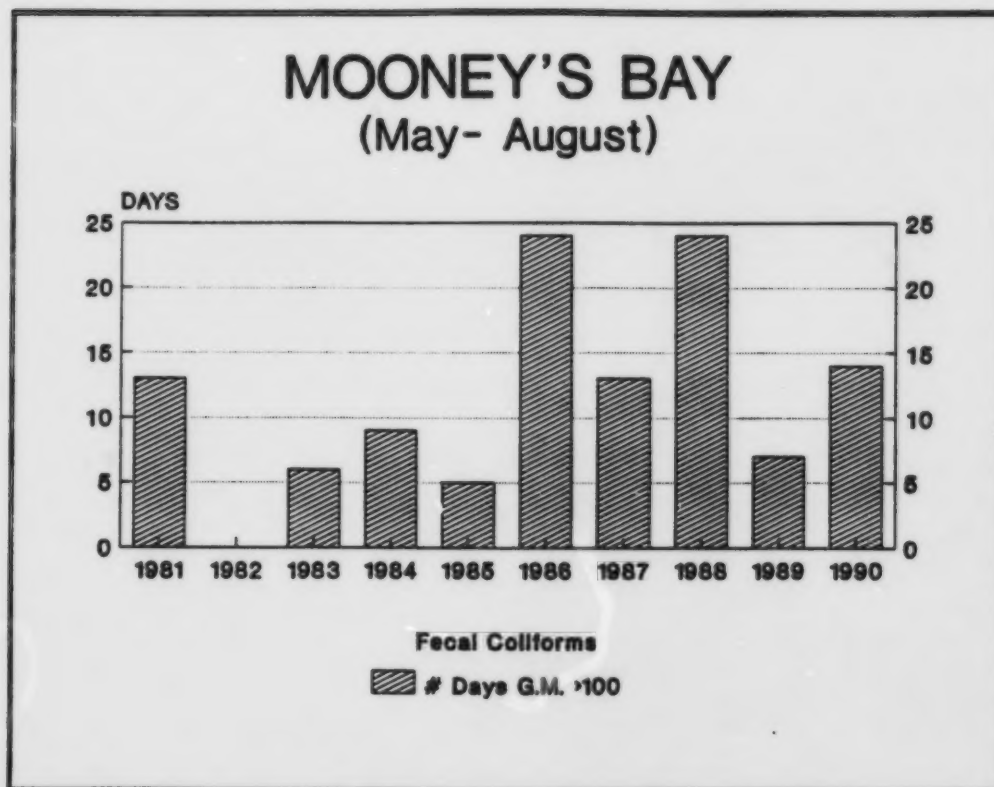
The three urban beaches in the Region- Mooney's Bay, Britannia Beach and Westboro Beach- have all been affected by high bacterial contamination in the past. Water studies conducted by area agencies such as Environment Canada, MOE, and the Regional Health and Environmental Services departments have shown a deterioration of water quality as it enters the urban area, and near the shorelines. One study indicated that the centre of the Ottawa River has much better water quality than the beaches or other shorelines.⁴²

C.1.1.4.1 MOONEY'S BAY

Mooney's Bay Beach is the only urban beach located on the Rideau River. In the past it has experienced inherently poor water quality because the natural contours of the bay inhibit water circulation. In the 1970s two circulating pumps were installed to bring water from the faster-flowing river centre to the bathing area. This markedly improved water quality at this beach.

Figure 21 illustrates the number of days bacteria levels exceeded the Ontario objective of 100 fecal coliforms/100 mL of water at Mooney's Bay in the past 11 years.

Figure 21 Mooney's Bay Beach

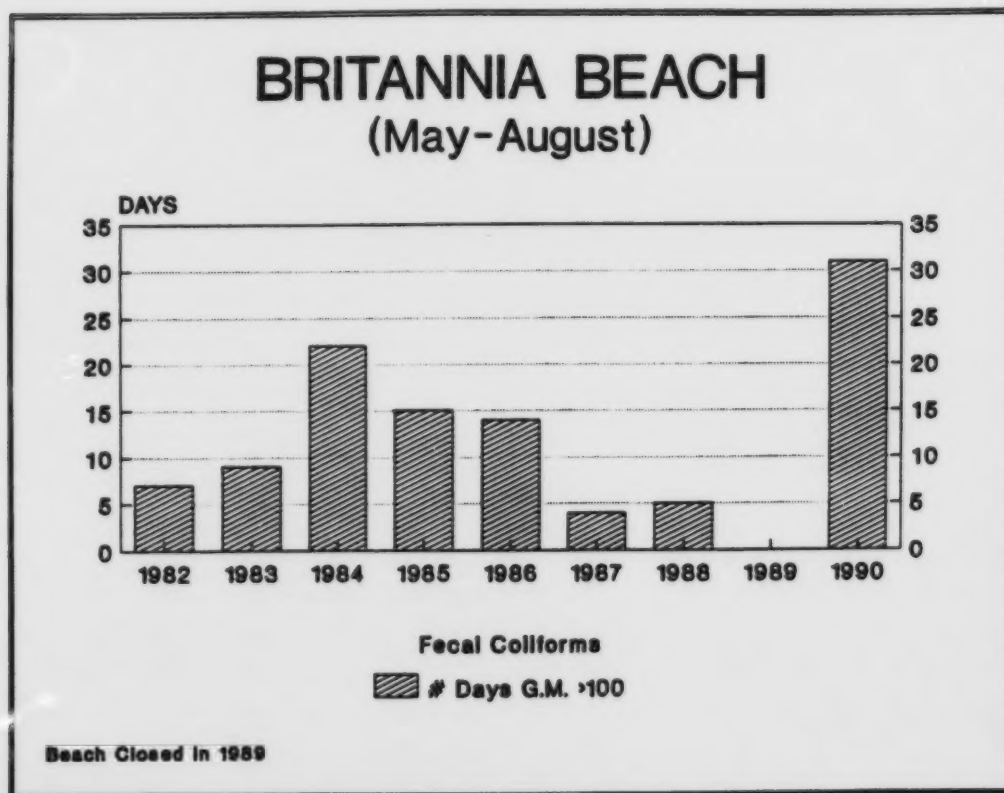


C.1.1.4.2 BRITANNIA BEACH

Britannia Beach is on the Ottawa River at the west end of the City of Ottawa. Its water quality is generally good, but the beach has been closed due to pollution levels several times a year over the past decade. Theories that try to explain the poor quality at Britannia Beach include the fact that the shallow regions in Lac Deschenes have a slower water flow and greater sediment disturbance; that storm sewers located near the beach may be influencing the water quality at the beach; and that water current patterns trap contamination water in the beach area.

Figure 22 illustrates the water quality at Britannia beach for the past eight years, in terms of the number of days bacteria levels exceeded the Ontario objective of 100 fecal coliforms/100 mL of water. Recent measures to improve the water quality at this beach include extending the pier upstream of the bathing area by 170 metres in 1987, and dredging the beach in 1989. The beach was closed for the 1989 bathing season while it was being dredged and bacterial results for that year are not included.

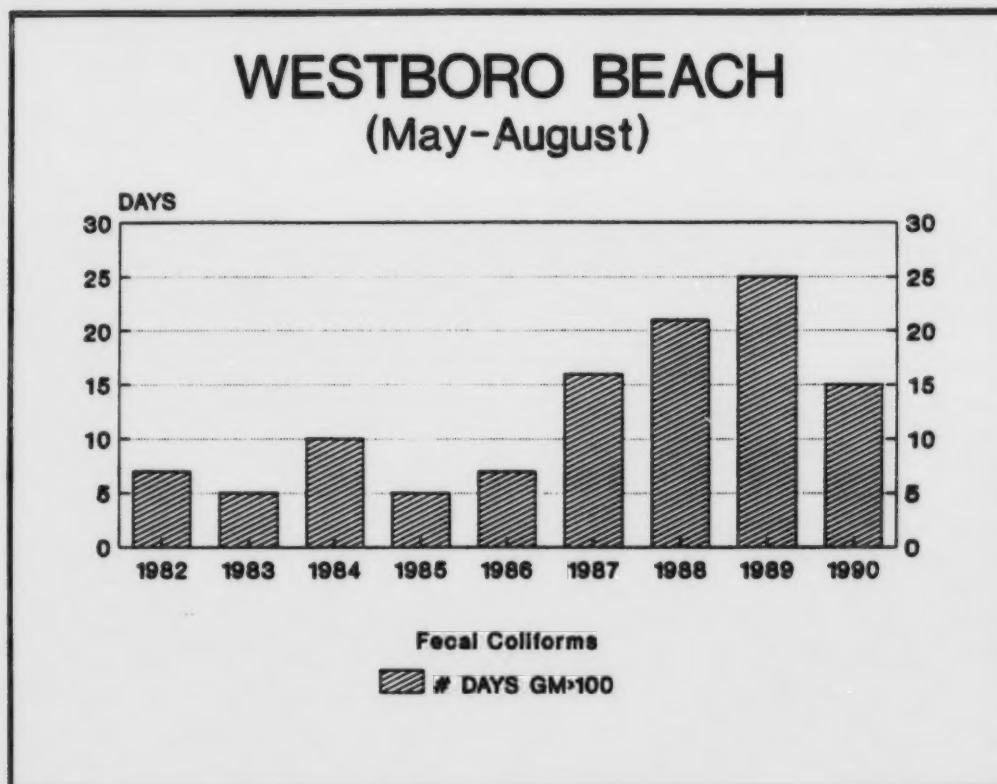
Figure 22 Britannia Beach



C.1.1.4.3 WESTBORO BEACH

Westboro beach is located downstream of Britannia Beach on the Ottawa River. From 1982 to 1988 this beach had relatively few water quality problems but in August of 1988 and 1989 it became severely contaminated. Figure 23 illustrates the number of days the bacteria levels exceeded the Ontario objective of 100 fecal coliforms/100 mL of water.

Figure 23 Westboro Beach



C.1.2 FISHING

The Ministry of Natural Resources (MNR) and the MOE continuously test fish in Ontario waterways. Mercury is the main contaminant of fish in the Region. Apart from mercury, local fish are tested for organic and inorganic chemicals such as DDT, mirex, PCBs and heavy metals.⁴⁰ Polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT have been detected in sediment and biota in the Ottawa River.⁴²

A *Guide to Eating Ontario Sport Fish* is published annually by the MNR and MOE.³⁰ It describes recommendations for safe fish consumption of fish by women of childbearing age, children under 15 and the general public. Because of high mercury levels, fish consumption is restricted in the Region. The *Guide to Eating Ontario Sport Fish* or the local MNR office should be consulted before eating fish caught in local waterways.

C.1.2.1 MERCURY IN FISH

Mercury was commonly used as an industrial chemical and occurs naturally in some area soils. It is found in the bottom sediments of local watercourses. Methyl mercury is the principle form of mercury found in food such as fish. Fish levels are usually below 200 nanograms per gram (ng/g), while other foods are usually below 20 ng/g.³¹ Health and Welfare Canada and the World Health Organization set an recommended maximum acceptable daily intake of 30 µg per day of methyl mercury for adults.

Fish accumulate mercury by eating plants that have taken up mercury from the soil or by filtering it from disturbed sediment suspended in water. They eliminate mercury at a very slow rate, and concentrations gradually accumulate in large fish that consume smaller fish. Prolonged consumption of contaminated fish can lead to chronic or acute mercury poisoning. Chronic poisoning results in emotional and psychological disorders. Acute poisoning causes birth defects, blindness, paralysis and even death in humans.³²

Fish from the Rideau River are more contaminated with methyl mercury than fish from the St. Lawrence River at Cornwall, the inner harbour of Toronto, and Lake Erie.³³ This is because heavy summer boat traffic on the Rideau stirs up bottom sediments containing mercury. In general, fish in the upper reaches of the Rideau and Ottawa rivers are less contaminated than those found in the urban areas.

C.2 SOURCES OF SURFACE WATER POLLUTION

The Ottawa and Rideau rivers' main pollution sources are sewage effluent, storm-sewer effluent, the after-effects of logging activities, and agricultural run-off. The Ottawa River is better able to handle pollution through dilution, dispersion, bacteria die-off and sedimentation processes than the smaller tributaries in the Region.⁵⁴ Surface pollution differs significantly in rural and urban areas.

C.2.1 RURAL CONTRIBUTIONS

The small creeks and streams that flow into the Ottawa and Rideau rivers originate in agricultural/rural areas. These tributaries are relatively clean at their sources, but as they flow through farms, villages and developed areas, many contaminants enter the watercourses. Pollution effects are usually restricted to the immediate area due to bacterial die-off and the ability of larger water courses to dilute pollutants.⁵⁵ This is illustrated by a study of the upper Rideau River where fecal coliform levels above MOE Recreational Water objectives were recorded in the tributaries of the Rideau River, but were below the MOE Objectives once they entered the Rideau River. Bacteria levels are monitored at the beaches by the Regional Health Department as these tributaries enter the Region on the Ottawa and Rideau river systems.

C.2.1.1 PRIVATE SEWAGE DISPOSAL SYSTEMS

Residential developments in rural areas are serviced entirely by private sewage disposal systems. Surveys show a large number of aging and malfunctioning septic systems exist, which leach untreated sewage into the surrounding land and, in turn, into watercourses (See Section II.B.3.2.2). This is a major source of rural bacterial contamination of surface water.

C.2.1.2 RURAL SEWAGE TREATMENT PLANTS

Sewage plant effluent from several small communities outside the Region affects the quality of area rivers. The most consistent polluters are the towns of Kemptville, which discharges sewage effluent into the Rideau River, and Almonte and Carleton Place which discharge into the Mississippi River. The Kemptville plant has only primary sewage treatment. In the opinion of the MOE, primary treatment is inadequate for the discharges put into the Rideau River, given its size and slow flow.⁵⁶ New plants for these communities are planned, but will not be completed until after 1992.

These communities often exceed the MOE operating criteria because sewage plants are overwhelmed and out of date. This results in frequent bypassing of treatment steps and discharging of raw sewage into the rivers. Sewage treatment plants in these communities have effluents high in total phosphorus, suspended solids and biological oxygen demand (BOD). BOD refers to the amount of oxygen in the water consumed in the microbial decomposition of organic matter. Total phosphorus levels in the Rideau River in 1990 were above the MOE Guideline level of 0.03 mg/L for rivers, with increased levels found downstream at the Black Rapids Dam.⁵⁷ Frequent by-passing of sewage treatment steps prompted the Medical Officer of Health for the District of Leeds, Grenville and Lanark to recommend no swimming in the Mississippi River downstream of Carleton Place, for part of the summer of 1990. Under normal operation, sewage is sufficiently treated with chlorine to pose no threat to swimmers.

C.2.1.3 AGRICULTURE

Many natural and commercial agricultural products adversely affect surface water quality when they are washed into watercourses by rain. This agriculture run-off is becoming more frequent as agriculture drainage systems improve. The South Nation, Rideau, Jock and Mississippi rivers are particularly affected by this phenomenon. Phosphates, nitrates and potash used to fertilize soils provide nutrients for weeds and algae. Agricultural pesticides are also washed into waterways; very low levels are found in Ottawa River biota and sediment samples.³⁰

Livestock operations near watercourses also contribute significantly to water quality degradation.³⁴ Run-off transports bacteria and nitrogen from manure storage areas, barnyards, feedlots, and manure-laden soil into the streams and rivers causing significant bacterial and fertilizer loading during a heavy rain.

C.2.1.4 FORESTRY INDUSTRY

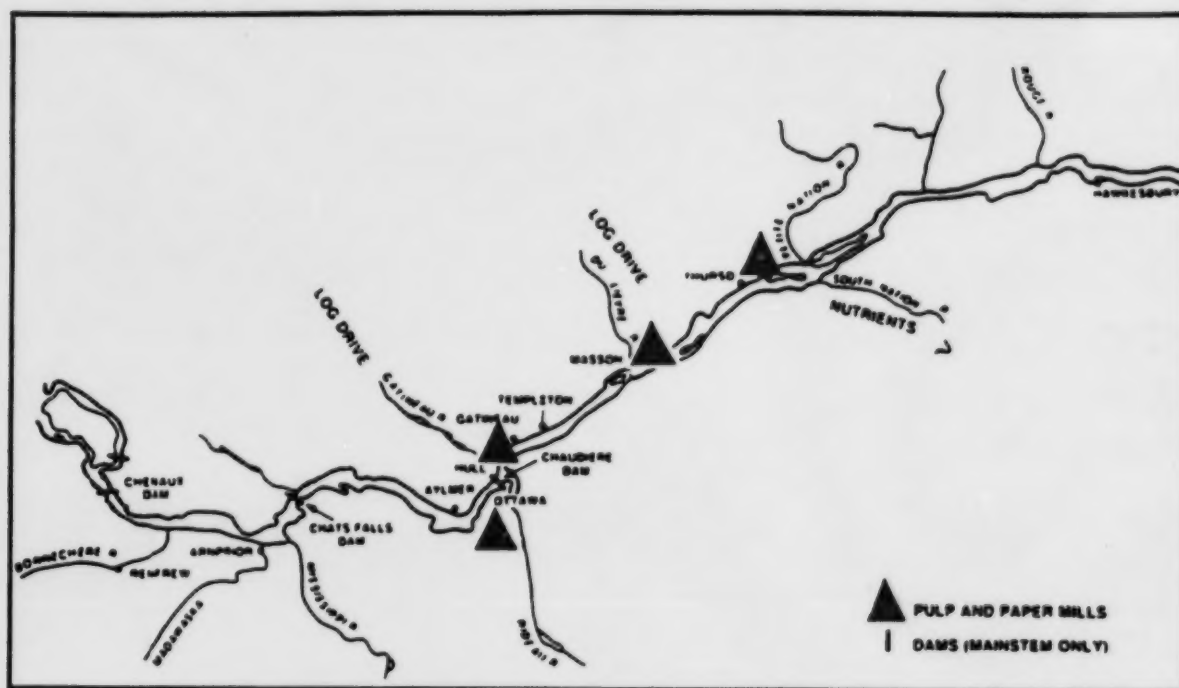
The Region was first established as a logging community in the early 1800s, and forestry continues to be a major industry today in the area. For many years logs were transported to pulp and paper mills via the Gatineau and Ottawa rivers. Despite the fact that the log drives are largely discontinued, they continue to affect water quality. Log drives on the Gatineau River in Quebec are expected to continue into the next decade until the highway system improves.

Debris such as deadhead logs, bark and wood chips cover large portions of the river bed. This interferes with fish spawning, smothers bottom-dwelling organisms and exerts a small but continual oxygen demand.³⁶ The hazards of logging debris, particularly logs that resurface, injuring boaters, affect human enjoyment and safety on the Ottawa River. It will take several more decades for the rivers to recover from the effects of the log drives.

There are currently six pulp and paper mills discharging wastes into the Ottawa River around Ottawa-Carleton. All except the E.B. Eddy plant, which is located partially in Ottawa, are situated in the province of Quebec (Figure 24).⁴² Two mills are located upstream of the Region, the other four are downstream from the water treatment plants and recreational water areas of Ottawa-Carleton. The effluents from the upstream plants are not a concern to either the drinking or recreational water of the Region. Pulp and paper mill effluent contains suspended solids and organic compounds that consume oxygen, as well as some toxic compounds that affect aquatic life. Toxic products such as dioxins are produced mainly in pulping and in bleaching pulp.

All pulp and paper mill waste discharged into the river is now subject to primary treatment at least. Only one of the mills on the river has secondary effluent treatment. While the E.B. Eddy plant has only primary treatment, it does not pulp paper. The other four plants which have only primary treatment have toxic effluents.⁴² The effluents which are toxic and have high oxygen demand (BOD), require further treatment. Three of the six mills exceeded their effluent quality targets in 1986 and have been working towards meeting their objectives through plant modifications and alterations.

Figure 24 Location of Pulp and Paper Mills on the Ottawa River



C.2.2 URBAN CONTRIBUTIONS

Municipal sewage treatment effluent, storm water run-off, and industrial sources all affect urban surface water quality in the Region. With the exception of the Ottawa River, the tributaries and rivers in the Region deteriorate rapidly as they enter the urban areas due to continuous urban pollution discharged into the watercourses. The Ottawa River is large enough to assimilate larger pollution loads than the smaller rivers and tributaries.

C.2.2.1 SEWAGE TREATMENT PLANTS

Raw or incompletely treated sewage is the most common source of river pollution in the Region. This discharge is mainly due to sewer main overflows and inadequate treatment plant capacities. Sewer main overflows occur when the sewer mains reach capacity during heavy rains, and sewage is diverted from the sanitary sewers into the storm sewer system. Treatment plant capacity has not kept pace with urban development, and treatment steps are by-passed when flows are too great to handle.

Water is 99.99% of sewage effluent. Contaminants are mainly suspended and dissolved organic solids, some inorganic matter, and microorganisms, mostly bacteria (several million per cm³). Sewage treatment is designed to reduce biological oxygen demand (BOD), suspended solids and, in some cases, phosphates. The MOE monitors and enforces discharge requirements for sewage treatment plants for compliance with these three parameters. Current standards are 70% removal of suspended solids, 50% removal of BOD and phosphorus content of no more than 1.0 mg/L.

Approximately 90% of all homes in the Region discharge their waste to the Regional central system through local sewers. The Regional Environmental Services Department operates the Robert O. Pickard Environmental Centre (formerly known as Green Creek Sewage Treatment Plant) and Watts Creek sewage treatment plants. The Robert O. Pickard Environmental Centre does primary sewage treatment and Watts Creek provides secondary treatment. The wetlands at Shirley's Bay provide a form of tertiary treatment at the Watts Creek facility. Both treatment plants discharge their final effluents into the Ottawa River.

Quebec municipalities once lagged behind Ontario in installation of sewage treatment systems. With the construction of new facilities, particularly the Outaouais Regional Community plant that serves Hull, Aylmer, and Gatineau, this situation is now reversed. The BOD and suspended solids output from Quebec have decreased to less than one-third of their 1976 levels. However, several small communities in Quebec still have no sewage treatment.

Ontario discharges, after decreasing sharply with the construction program of the 1970s, are rising again and now exceed Quebec discharges.³⁶ Only 25-30% of municipal sewage in Ontario now receives secondary treatment, which removes most of the BOD and some of the toxicity. The capacity of the largest sewage treatment plant in the Region - the Robert O. Pickard Environmental Centre has been exceeding the MOE operating guidelines of suspended solids, BOD and phosphorus for the past decade. The plant is currently undergoing a major upgrading to meet these requirements.

Expansion and upgrading of the Robert O. Pickard Environmental Centre to meet current and future sewage volumes produced in the Region has been underway since 1988. Enlargement of primary clarifiers should be completed by 1992 to provide for projected growth to 2011. By 1992 the system

will be providing secondary sewage treatment and phosphate removal for all sewage going through the plant.

C.2.2.2 STORM WATER RUN-OFF

A 1983 study of the Rideau River storm water management suggested that storm water retention ponds could significantly reduce levels of suspended solids, total phosphorus and fecal coliform levels discharged into the Rideau.³⁴ Significant urban bacterial sources include: street run-off washing away feces from domestic animals; birds roosting near water; leaking sanitary sewers in older areas of the cities; designed overflows from the sanitary sewer system; and cross-connections from alterations of plumbing systems.³⁴

Sixteen retention ponds are set up on the Rideau River to settle suspended sediments and attached bacteria before storm water is discharged to the river. Actual operation of these ponds has been less than satisfactory. Operational deficiencies by those responsible for maintaining them have contributed to poor effectiveness. With proper maintenance, it is felt they could achieve their designed objectives. There are a few storm water retention ponds on the Ottawa River.

Currently all new development on the Rideau River watershed is required by the MOE to treat storm water prior to its discharge to meet a standard of 100 fecal coliforms per 100 mL and 25 mg/L suspended solids. A pilot ultraviolet light disinfection system is being tested in Barrhaven by the City of Nepean to improve the quality of effluent from storm water ponds.

C.2.2.3 COMBINED SEWERS

Until the early 1970s, combined sewers (which carry both sanitary wastes and stormwater run-off) were still being installed in the Region. Wastes from combined sewers are directed to the Regional sewage treatment plants and create volume problems. During heavy flow, portions of the waste are diverted directly into the Ottawa River. Since early 1970, combined sewers have been prohibited and area municipalities have been working to separate existing combined sewage lines. The objectives are to prevent basement flooding, reduce flows to the treatment plant and improve water quality.

RMOC Sewer By-Law No. 208 of 1984 governs sewer discharges and operations. It requires sanitary sewers and storm water sewers built after 1983 to be separated. The sewer separation program is mainly a concern for the City of Ottawa where major areas are serviced by combined lines. The City of Ottawa is studying alternative methods of meeting the sewer separation program objectives because separation is a very slow and expensive process.

By-Law No. 208 also dictates effluent quality in sanitary and storm sewers. Gasoline, fuel and oil are not permitted, and many parameters such as BOD levels, suspended solid levels, heavy metals, temperature, pH, odours and radioactive wastes are monitored. Individuals and municipalities must obtain the Region's approval prior to connecting any sewers or watercourses to the Regional sewage system. Approval is granted upon provision of detailed plans, specifications, and chemical and physical analysis of the sewage. The RMOC can order individuals to abate, control, treat or discontinue discharging sewage if a problem is found.

C.2.2.4 INDUSTRIAL POLLUTION

Industrial contamination of watercourses in the Region is usually a result of improperly connected plumbing, improper grounds maintenance of outdoor storage areas, improper disposal methods or the discharge of materials into the sanitary sewer system. In 1988 charges were laid by RMOC and the City of Ottawa for an industry dumping xylene and toluene into the sanitary sewer system.

C.2.2.4.1 ELECTRONICS INDUSTRY

There are approximately 130 electronics manufacturers in the Ottawa-Carleton area, of which about 65 generate hazardous wastes.⁵⁷ Two-thirds of Canada's electronic manufacturing takes place in Ontario, and Ottawa is the centre of semiconductor manufacturing in Ontario.

The electronics industry is chemical-intensive in the manufacturing of devices. Large quantities of solvents and cleaners are used to remove contaminants from the workplace and some (eg. tetraethyl ammonium hydroxide) are released to the sewage system where they become a concern. Small circuit-board manufacturers use a wide variety of chemicals and generate substantial quantities of hazardous waste. The limited resources of these companies to dispose of and treat wastes adequately before they leave the premises may result in adverse environmental effects and is a concern to the MOE .

Acidic discharges from this industry have been suspected of causing sewer collapses in the past. In another incident, the sludge digestion process at one of the sewage treatment plants was disrupted due to excess copper discharges attributed to the electronics industry.

The MOE is also concerned about heavy metal discharges to sewers.⁵⁷ Diluted volumes of metals from plants meet the requirements of the sewer by-law. However, the large overall volumes generated in the Region could affect water quality. Increased use of arsenic in the industry, and the impact of new chemicals have not been fully assessed.

C.2.3 OTHER SOURCES OF POLLUTION

Other sources of pollution to our waterways include point sources such as accidental spills (eg. oil or gasoline) and continuous sources such as rain-water run-off. Following are the more common contaminants:

- 1) **OILS, GREASE AND TARS:** Immiscible liquids such as oils, greases and tarry substances from industrial effluent cause thin films on the water's surface which reduce oxygen transfer from air to water, creating a problem for fish and plants. These substances can give water bad tastes and odours.
- 2) **SLUDGE:** Sludge waste from Britannia and Lemieux Island Water Treatment Plants is discharged directly into the Ottawa River. Although this sludge poses no direct health hazards, sludge treatment has been proposed and is under review.
- 3) **SALT AND HEAVY METALS:** Salt and heavy metals from snow dumps contribute seasonal pollution to surface and ground-water in the spring (See Section III.C.4).

4) **BOAT HOLDING TANKS:** Boats are prohibited from discharging sewage waste into the river under Ontario Regulation 305 of the Environmental Protection Act. Legislation is also being proposed by the MOE to prohibit grey water (sink and shower water) discharges. Marinas and docking facilities have facilities to handle this type of waste.

C.3 INITIATIVES TO IMPROVE SURFACE WATER QUALITY

C.3.1 AGENCIES RESPONSIBLE FOR OVERSEEING WATER QUALITY

There are many agencies in the Region dedicated to improve local water quality.

1) **OTTAWA RIVER WATER COORDINATING COMMITTEE:** This committee includes representatives from Environment Canada, Environment Quebec and Environment Ontario. It published two progress reports entitled "Water Quality in the Ottawa River" in 1985 and 1989.⁴ The reports identify the two major pollution sources as the forestry industry and municipal waste water disposal.

The reports make specific recommendations to pulp and paper mills discharging toxic waste into tributaries of the Ottawa River, as well as targeting the Robert O. Pickard Environmental Centre and some small communities in Quebec that do not have any sewage treatment. The report recommended that Robert O. Pickard Environmental Centre schedule primary treatment expansion by 1989 and provide secondary treatment or equivalent by 1992. These recommendations are being acted on (See Section II.C.2.2.1).

2) **TECHNICAL POLLUTION ABATEMENT COMMITTEE (TPAC):** TPAC is a cooperative committee chaired by the RMOC and made up of operational staff from area municipalities and environment agencies. The committee tries to correct urban water pollution sources and deals with point-source discharges or areas of poor water quality. Problems relating to pollution sources of domestic sewage, chemical spills, industrial and institutional wastes are investigated and reports forwarded to the responsible party for correction. In 1978 TPAC reported that over 700 pollution sources had been identified and the problems rectified since its inception in 1971. This has resulted in a marked improvement in the quality of the Rideau river upstream of Hog's Back.⁵⁴

Each year it summarizes its findings in a report. In 1988, 54 pollution sources were reported, 46 dealing with bacterial contamination and 8 involving industrial discharges. Bacterial pollution of storm sewers was found to be caused by blockages, cracked or shifted pipes, and improperly connected plumbing. After identification of pollution sources, the responsible agency is notified and the committee follows the case until it is satisfactorily resolved.

3) **RMOC ENVIRONMENTAL SERVICES DEPARTMENT, WATER POLLUTION CONTROL DIVISION:** This RMOC branch monitors urban storm sewer systems and samples the Ottawa and Rideau rivers for water quality. The branch is also setting up a program to monitor industrial discharges pending the implementation of the Municipal/Industrial Strategy for Abatement.

4) **REGIONAL WATER QUALITY COMMITTEE:** Late in 1990 the Region formed a committee whose objective is to coordinate the clean-up of area watercourses, particularly the Rideau River. The Region will take a lead role in coordinating and directing the efforts of area municipalities.

C.3.2 PROVINCIAL INITIATIVES

1) MUNICIPAL/INDUSTRIAL STRATEGY FOR ABATEMENT (MISA) PROGRAM: MISA is a government of Ontario plan to reduce water pollution. The program targets the source of pollution with industry-specific regulations. The MOE and the industries involved are studying what is achievable with current technology.

The program will include two kinds of requirements: monitoring and abatement. The monitoring regulations will require dischargers to measure the types, concentrations and total amounts of toxic substances present in their effluent. The abatement regulations will set limits based on best available technology economically achievable (BATEA) to reduce the concentrations and amounts of toxic substances discharged. The monitoring program is nearly complete and the regulations are in progress.

The municipal sector (sewage treatment) and possibly the pulp and paper sector will be most affected in the Ottawa-Carleton Region. Most of the sectors included in MISA are not located in our Region (eg. petroleum refining, electric power generation).

2) LIFE LINES (MOE): This is a new program to ensure the delivery of clean water to consumers and to protect Ontario's surface water. It offers financial assistance to municipalities to develop plans to remedy existing water pollution problems, and to assess and repair their drinking water and sewer lines.

C.3.3 LOCAL INITIATIVES

1) STOOP AND SCOOP BY-LAWS: All area municipalities, except Rockcliffe Park, West-Carleton and Rideau townships, have by-laws requiring pet owners to pick up any fecal matter that their pets excrete in public places. These by-laws aim to decrease the bacterial load in run-off.

2) IMPROVEMENTS TO AGRICULTURAL SOIL MANAGEMENT: Agricultural run-off from farms into tributaries of the Ottawa and Rideau rivers can be controlled by soil management practices such as:

- improvement of the soil structure to prevent leaching of fertilizers and pesticides,
- improved tilling practices,
- leaving a "trash" cover over the winter to prevent leaching,
- improved handling and storage of chemicals,
- employment of larger buffer zones around water courses for application of chemicals, and
- the use of less toxic pesticides, in smaller quantities.

These measures can reduce the amount and type of chemicals polluting watercourses²⁴; many have already been taken, particularly in the South Nation basin.

3) RIDEAU STORMWATER MANAGEMENT STUDY 1990: A major study of storm water management on the Rideau River in 1983 recommends how water quality could be improved on the lower Rideau River and a wider range of recreational uses permitted.

To date, these recommendations have not been fully acted on. Those involved in the study (federal, provincial, regional and municipal agencies) agreed that a second study was necessary. An update of this study is now being undertaken. A report and recommendations on how improvements should be implemented will be released in the summer of 1991.

4) RIDEAU VALLEY CONSERVATION AUTHORITY BEACHES PROGRAM WATER QUALITY STUDY 1990: The Rideau Valley Conservation Authority (RVCA) is currently undertaking a two-year study to identify sources of bacterial and phosphorus loading in the rural portion of the Rideau River watershed. This study is funded by the MOE and has just completed the first year of data collection, which identified non-point sources of water pollution and ranked beaches in terms of priority for remedial action.

The second year of the study will prepare an action plan to remedy rural, non-point sources of pollution and conduct a livestock operation survey. It is anticipated that the RVCA will then begin implementation of this plan.





LAND





A INTRODUCTION

Rapid population growth and the corresponding conversion of agricultural and vacant land to residential and industrial uses increases the potential for land use conflict. Good land-use planning minimizes this conflict by segregating industrial parks and high density traffic corridors from residential areas.

Thanks to early land-use planning, Ottawa-Carleton has had great success in establishing recreational greenspace and buffer zones. Beginning with the federal government and continuing with the municipalities, 90 years of planning has produced one of the best greenspace systems in the world.

However, early planning did not always take into account the impact of urban expansion. Industry and waste disposal sites that were once located at the edge of town are now inside urban areas, and potentially hazardous waste remains in some sites. One of the big challenges of governments today is dealing with the past, present and future of solid waste disposal.

Four other issues affecting health and enjoyment of regional lands are discussed in this report: wetlands, pesticides, noise and electromagnetic fields.

B RECREATIONAL GREENSPACE

Ottawa-Carleton residents benefit from a rich heritage of publicly owned parkland, natural areas and open space. Most live less than half an hour away from natural areas where one can hike through nature trails, bird watch and enjoy beautiful scenery.

Greenspaces act as physical and psychological buffers between people and the urban environment. Urban stresses include fast-paced living, high population densities and increased pollution. Greenspace contributes open spaces and helps cleanse the air of pollutants. In the summer it both "air conditions" overheated urban areas and provides a cool respite to residents.⁵⁹

Ottawa-Carleton's green spaces offer walking, hiking and safe bicycling paths. Thanks to this network of pathways, many workers can commute to work on foot or bicycle - both environmentally friendly options. In winter, some residents even "commute" on skates down the Rideau Canal. Greenspace also provides a focal point for social activities. People-watching and opportunities to interact with others may alleviate the loneliness that can accompany urban life. Because greenspaces are publicly owned, all members of the community can use outdoor spaces and recreational facilities, whether for unstructured activities or organized sport and recreation, at little or no cost.

In many other urban areas, outdoor facilities for physical activity are limited. Ottawa-Carleton's abundance of maintained greenspace, particularly in the urban areas, is a strong motivator for physical activity. Promotion of physical activity is an intrinsic aspect of public health, as there is convincing evidence that physical activity and overall health are linked.

Physical activity has beneficial effects on the bodies, minds and well-being of children, adults and the elderly.⁶⁰ People who exercise regularly have decreased body fat, and better coordination, endurance and strength. Elderly and handicapped people who exercise regularly experience improved mobility and decreased risk of heart attack and other diseases. For all ages, sedentary life style has a strong association with coronary heart disease.⁶⁰

Participation in physical exercise also has mental and social benefits. Rhythmic exercise for several minutes relaxes neuromuscular tension,⁶¹ decreasing stress and anxiety. Exercise also reduces depression and improves morale and emotional well-being. A well-conditioned body also promotes improved self-concept and self-esteem. Physical activity reduces health care costs, provides a forum for meeting people and fosters an environment where people can live and work together in harmony.

B.1 FEDERAL GREENSPACE

As Canada's capital, Ottawa benefits from years of federal greenspace planning. As early as 1899, the predecessor of the National Capital Commission (NCC) was responsible for cleaning up the banks of the Rideau Canal, constructing the Queen Elizabeth Parkway, and beginning the park system by taking over maintenance of Rockcliffe Park from the City of Ottawa.⁴² The first professional planner, hired in 1903, recommended preserving large natural parks on forest lands adjacent to the Capital and constructing an impressive boulevard linking Rideau Hall and the Parliament Buildings.

In 1946, Parisian architect and town planner Jacques Gréber was invited to Ottawa by the National Capital Planning Committee to design a master plan for the national capital. The Gréber Plan was tabled in Parliament in 1951 and formed the basis for planning well into the 1960s. Three of the five recommendations dealt primarily with greenspace in the RMOC. It recommended:

- 1) removing railway lines from the centre of the city
- 2) establishing parks and parkways
- 3) decentralizing government buildings from the downtown core
- 4) establishing a greenbelt around the urban area
- 5) establishing a park in the Gatineau Hills.

B.1.1 PARKS AND PARKWAYS

Gréber suggested that the attraction of the National Capital lay "in the charms of its large wooded vistas, its picturesque canals and falls, the grandeur of its parks and monuments."⁴³ Thus, an important element of the Gréber Master Plan was the creation and conservation of greenspace in the form of parkways along the Ottawa and Rideau rivers and large parks in natural areas.

The work of past commissions was continued and expanded by the National Capital Commission. Properties were acquired to establish parks, construct parkways, and to preserve, protect and appropriately use riversides. Property along the banks of the Rideau Canal and of the Ottawa, Rideau and Gatineau rivers was purchased and restored to its natural beauty to allow public enjoyment of the waterways. Including these waterfront areas in the NCC mandate permits better control over land influence on the water systems and protects the waterfront property from exploitation. At present, most of the shoreline along the Ottawa and Rideau rivers within the urban area is publicly owned. The Rockcliffe and Ottawa scenic parkways follow the Ottawa River, and Queen Elizabeth Drive and Colonel By Drive run along the Rideau Canal. These waterside and parkland buffer zones benefit all residents, and provide areas for both passive and active recreation.

The NCC also owns and maintains several urban parks, including Vincent Massey Park and Rideau Falls Parks and, through an agreement with the City of Ottawa, is responsible for maintaining several municipal parks including Rockcliffe Park. The NCC maintains large tracts of land around federal government buildings as well as the flower beds in most of the parks and scenic routes.

The NCC parks and parkways form the backbone of the Region's recreational life. Two of its better known features are the bike paths and the Rideau Canal. The NCC operates 130 kilometres of bike paths throughout the urban corridors, including Gatineau Park.⁴⁴ Residents and tourists use these

pathways for a variety of recreational activities including walking, jogging, biking and cross country skiing.

Early in its history, the Rideau Canal's main function was transportation. It was one of the first areas within the urban area to be converted to greenspace and is now a recreational focal point. Five historic lock-stations are located in the Region: the Ottawa Locks by Parliament Hill, Hartwell's at Carleton University, Hog's Back, Black Rapids and Long Island in Manotick. The Canal Promenade runs for 8 km from downtown Ottawa to Carleton University. In the winter, the canal turns into the "World's Longest Skating Rink". In the summer, the Rideau Canal system is enjoyed by recreational boaters.

B.1.2 THE GREENBELT

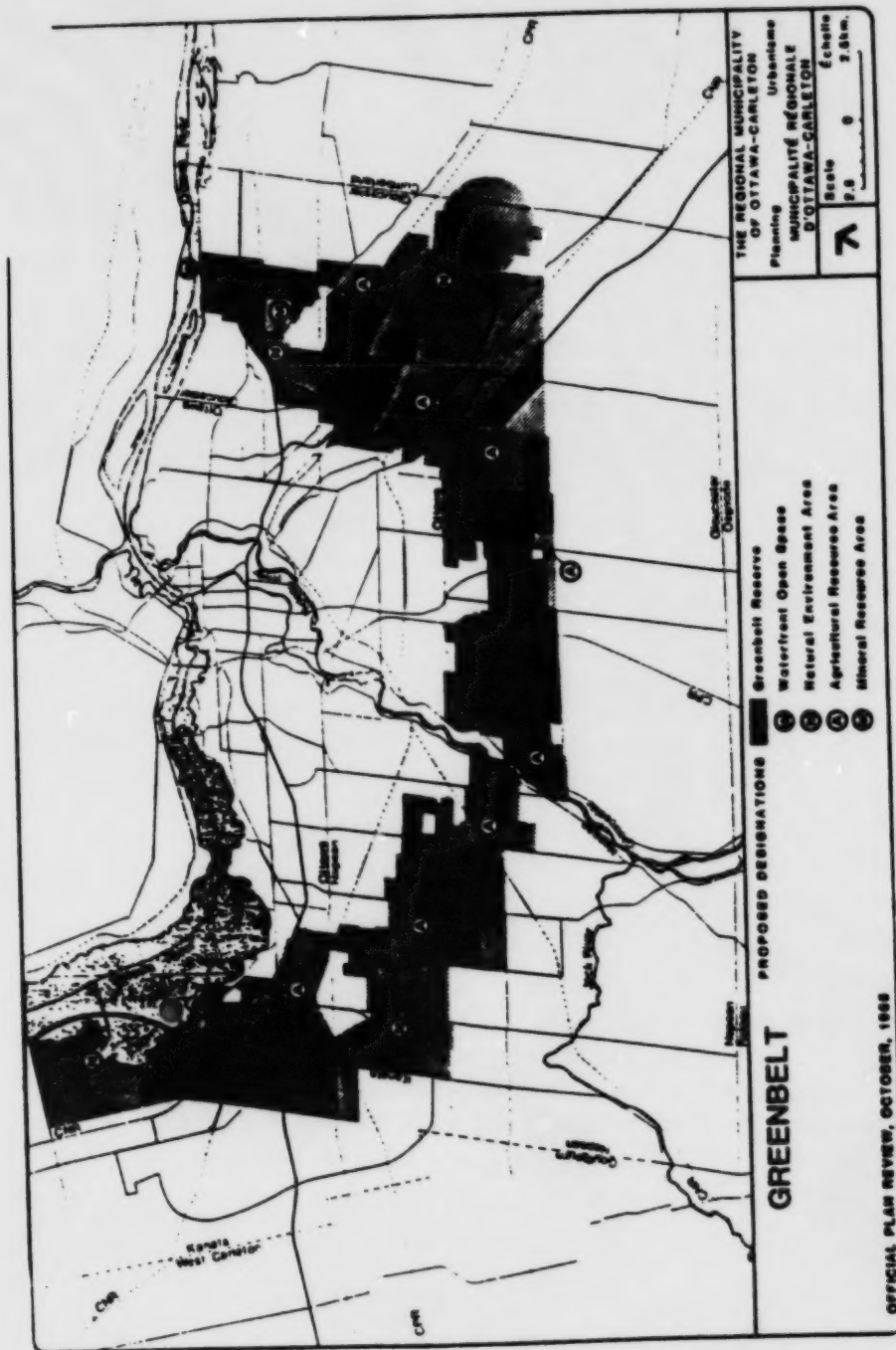
The greenbelt is one of the most ambitious planning measures implemented by the NCC to control the size, shape and nature of the Capital's development. The greenbelt was designed to:

- 1) confine urban development to an area that could be provided with sewer and water facilities at a reasonable cost
- 2) avoid uncontrolled urban sprawl and unsightly ribbon development along the main highways into the city
- 3) provide future parks and public open space
- 4) provide land for future government building sites, public and private institutions and selected light industries
- 5) allow the conservation of sensitive areas.

In 1958, the federal government granted the NCC the authority and government loans to acquire the lands necessary for the development of the greenbelt. Land was acquired through purchase when possible and expropriation when necessary.

The greenbelt forms a semicircular belt around Ottawa, about 17 600 hectares (ha) in area. The continuous 44.8 km arc begins about 9.6 km south of the Peace Tower and averages 4 km in width (Figure 25).⁶⁴ The land has many uses. Some is leased, some is in public use, some houses public and privately owned research and development activities, and some has been set aside as conservation areas. Reforestation of lands in the "urban shadow" and protection of water courses and swamp areas protect the water table, thus ensuring that lands both inside and beyond the greenbelt continue to have adequate water supply. All land is strictly supervised and managed by the NCC.

Figure 25 The Greenbelt



The greenbelt has had a great influence on the development of Ottawa-Carleton but it has not prevented urban sprawl beyond its boundaries. Urbanization in the last 30 years has accelerated much faster than expected. There are now three distinct urban areas outside the greenbelt. To respond to growth and change, the NCC is now conducting a three-year review to develop a new master plan for the greenbelt. The new plan will focus on such important issues as:

- 1) the long-term role of agriculture
- 2) the integrity of ecological resources
- 3) reconciliation of the NCC's mandate with municipal and Regional mandates to provide services, roads and recreation
- 4) the role and management of greenbelt buildings

B.1.3 CONSERVATION AREAS

There are four NCC-managed conservation areas located on federal property⁴⁵ (Figure 26). These areas provide a refuge for residents from the urban environment, and a focal point for educating the public to appreciate nature and wildlife.

1) **BRITANNIA CONSERVATION AREA:** This level, wooded area centred on Mud Lake near the Britannia Water Treatment facility on the Ottawa River is unique, located within an urban area yet retaining wilderness character. It is one of the best bird-watching areas in the RMOC.

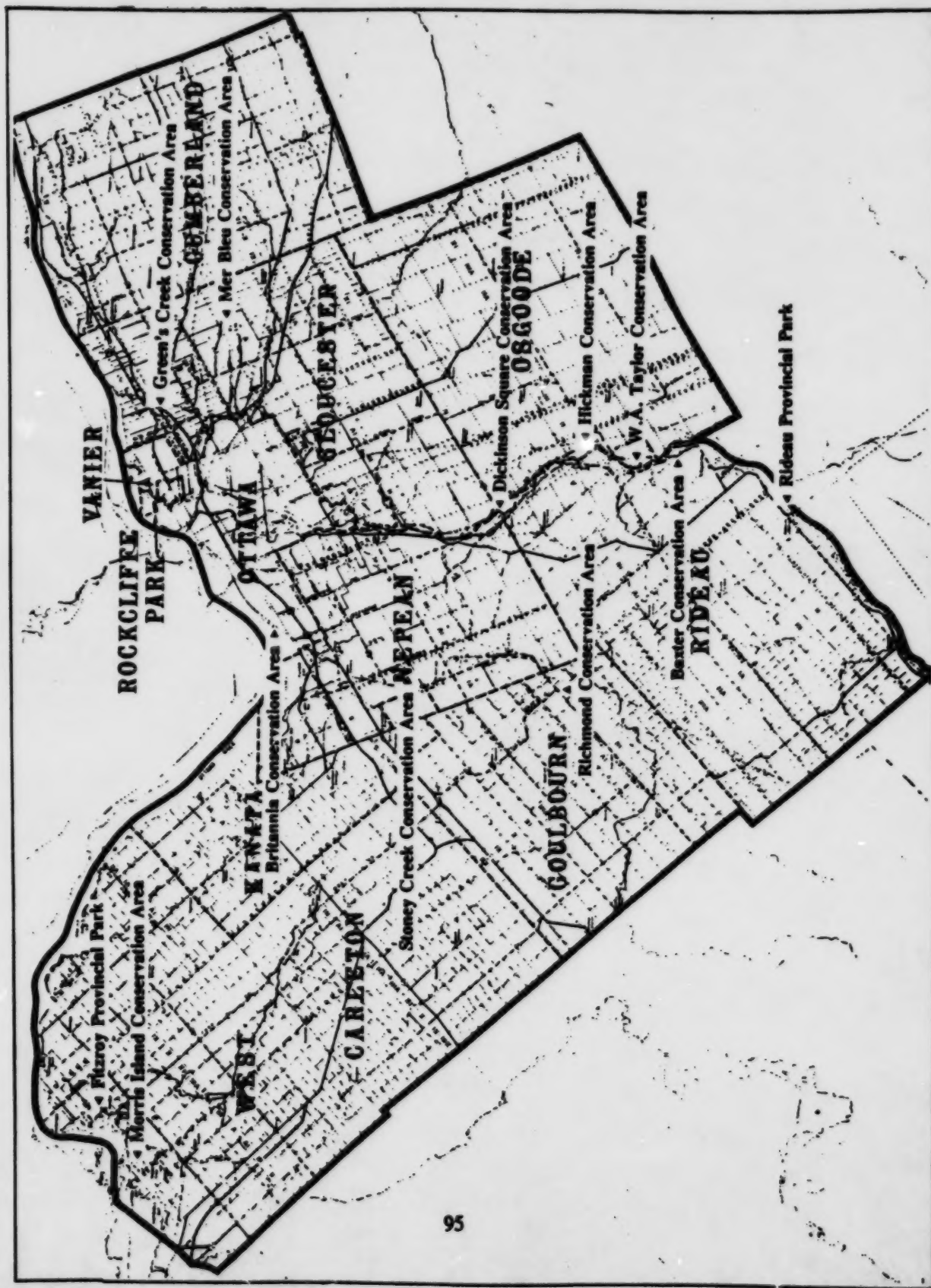
2) **STONY SWAMP CONSERVATION AREA:** This 2000 ha area in the greenbelt within the City of Nepean contains many kinds of upland and lowland habitat, representative of natural areas found south of the Ottawa River. These habitats include a sugar maple forest, boggy wetlands and regenerating pastures. An Interpretive Centre runs educational programs on the area. Nature trails are maintained year round.

3) **GREEN'S CREEK CONSERVATION AREA:** This 400 ha area in the greenbelt within the City of Gloucester follows Green's Creek from Innes Road to the Robert O. Pickard Environmental Centre. It is situated on highly unstable marine clay, which has discouraged development.

4) **MER BLEU CONSERVATION AREA:** This 5000 ha peatland located in the greenbelt within the City of Gloucester and Township of Cumberland is one of the largest bogs in Ontario, and probably the most significant natural area within the RMOC. The NCC owns 3100 ha and manages it as a conservation area. A network of walking and ski trails is maintained for recreational use.

Figure 26

Federal and Provincial Conservation Areas and Provincial Parks within RMO



B.2 PROVINCIAL GREENSPACE

B.2.1 PARKS

The Ontario Ministry of Natural Resources (OMNR) maintains 261 provincial parks covering approximately 6% of the province's land and water base. Provincial parks vary considerably in size and use. Each is classified as either a recreation, natural environment, wilderness, waterway, historical or natural reserve park. The two provincial parks in the Region (Figure 26) are both recreation parks with beaches and facilities for camping, day use, boating and nature trails. Fitzroy Provincial Park is on the Ottawa River in the Township of West Carleton. Rideau River Provincial Park is on the Rideau River in Rideau Township.

B.2.2 CONSERVATION AUTHORITIES

Ontario is divided into 31 conservation authorities affiliated with specific watersheds. Each authority participates with federal and provincial agencies to manage renewable natural resources within its jurisdiction. Authorities are responsible for flood control, conservation areas, fish and wildlife, historical sites, information and education, reforestation and land use throughout the watershed. There are three conservation authorities with jurisdiction within RMOC: the Mississippi Valley Conservation Authority, Rideau Valley Conservation Authority and South Nation River Conservation Authority. Conservation areas maintained as recreational greenspace by these authorities are listed in Table VIII, Figure 26.

Morris Island is a new conservation area, originally begun in 1986 and officially opened to the public in June 1990. It is the only RMOC conservation area operated by the Mississippi Valley Conservation Authority. Dickinson Square (in Manotick), Baxter (south of Kars) and W.A. Taylor (west of Osgoode), are owned and operated by the Rideau Valley Conservation Authority. They also own two undeveloped areas; natural river marshland north of Roger Stevens Drive on Regional Road 13 (Hickman) and a river front property on the Jock River at McBean Street (Richmond). There are no conservation areas in the Region operated by the South Nation River Conservation Authority.

Table VIII Provincial Conservation Areas within RMOC

No.	Conservation Area	Size (ha)	Municipality	Conservation Authority	Facilities
1	Morris Island	47	West Carleton	Mississippi Valley	Canoeing, nature trails, fishing, picnic facilities
2	Richmond	3	Goulbourn	Rideau Valley	Waterfront park
3	Dickinson Square	1	Rideau	Rideau Valley	Authority HQ, Watson's Mill, Dickinson House, A.E. Ayers Bld., H.E. Henry Bld.
4	Hickman	10	Rideau	Rideau Valley	Natural wildlife area
5	Baxter	68	Rideau	Rideau Valley	Interpretive centre, beach, nature trails, picnic facilities
6	W.A. Taylor	7	Osgoode	Rideau Valley	Boat launch, picnic facilities

B.3 MUNICIPAL GREENSPACE

The recreational open space administered by area municipalities is listed in Table IX^{66,67} and Table X.⁶⁷ Nepean and Ottawa, which are the oldest and largest established urban areas, classify their parks in terms of size.

Table IX **Municipal Parks in Ottawa and Nepean**

Park Level	City of Ottawa	City of Nepean
City Parks	6 (80 Hectares)	15 (including 4 conservation areas)
Community Parks	58 (281 hectares)	52
Neighbourhood parks	178 (90 hectares)	45
Total	242 (388 hectares)	112

City-level parks serve the urban area as a whole and are usually 10 to 15 ha in size with good transportation access. They may include leisure facilities such as swimming pools, arenas, sports fields, beaches and community centres.

Community level parks are usually less than 10 ha with good transportation access and may include the same recreational facilities as city parks. They are intended to serve several neighbourhoods, but not the city as a whole.

Neighbourhood parks meet the needs of the immediate area. They vary in size, but are generally much smaller than the other two types of parks. They contain less structured leisure facilities that include play equipment, unlit sports fields, outdoor rinks, tennis courts and small community centres.

The nine other municipalities tend to have smaller parks classified either for active or passive use (Table X).⁶⁷ Active parks contain ball parks or other equipment and are often associated with a community centre. Passive parks are maintained as greenspace only.

Table X **Parks in Other Municipalities**

Municipality	Number of Parks			Total land Hectares
	Active ^a	Passive ^b	Total	
Cumberland	18	11	29	NA
Gloucester	NA	NA	155	203
Goulborn	18	24	33	71-81 ^c
Kanata ^d	17	36	53	NA
Osgoode	5	20	25	NA
Rideau	9	28	37	40
Rockcliffe Park	3	2	5	NA
Vanier	10	1	11	6
West Carleton	6	2	8	NA
a. Active parks contain recreational facilities b. Passive parks are maintained greenspace only c. This includes school parks d. Kanata also has one conservation area				

C SOLID WASTE MANAGEMENT

Canada produces 1.7 kg of waste/person/day, more per capita than any other country in the world.²³ The responsibilities for waste management are shared by provincial, regional and municipal governments. Ontario regulates waste disposal management and environmental impact through the *Environmental Protection Act* and the *Environmental Assessment Act*.

Attitudes to waste disposal have changed drastically in the last 20 years. In the past, little thought was given to how waste sites affect the surrounding environment. As a result, waste management planners today must simultaneously deal with the past, cope with the present and plan for the future.

Solid waste includes all biodegradable waste except body wastes. There are several categories of solid waste, including residential, commercial/industrial/institutional, municipal, agricultural and specialized wastes.²⁴

Residential waste makes up a third to half of the total waste stream in the Region and includes all types of solid waste produced by households. This waste includes all organic and kitchen wastes, paper, boxes, wood, yard trimmings, metal cans, dirt, glass, ashes, furniture, appliances, tires and cars.

Commercial/industrial/institutional waste is solid waste generated by the wholesale and retail trades, hotels, restaurants, offices and institutions. Included in this category are all the types of solid waste listed in the residential category, as well as demolition and construction wastes.

Municipal waste includes street litter, sewage sludge and snow. The municipalities are responsible for collecting municipal waste, and the Region is responsible for its disposal.

Agricultural waste includes animal manures, garden and crop residues, and animal carcasses. Most agricultural waste is managed by the individual farmer and is not considered in this report. Manure and plant residues are recycled by spreading and working back into the land; animal carcasses are buried or shipped for disposal outside of the Region; and bulky wood residues can be burned with permission from the local fire department.

Specialized wastes include medical, chemical, radioactive wastes and contaminated soils. Special wastes are not included in this report. The generation of special waste within Ottawa-Carleton is not large enough to warrant having our own facilities, so these wastes are safely contained and disposed of in specialized facilities outside the Region.

Soils contaminated with fuel spills in concentrations under MOE limits²⁵ may be disposed of as commercial waste. Those with chemical concentrations over guidelines are treated as hazardous waste and shipped to specialized facilities outside the Region.

C.1 HEALTH HAZARDS ASSOCIATED WITH SOLID WASTE

Proper management of all types of solid waste is important for the maintenance of public health standards. Improper management of solid waste can lead to biological and chemical contamination of land, water or air, compromising residents' health.⁶⁸

1) BIOLOGICAL CONTAMINATION: Historically, large outbreaks of disease have been attributed to poor sanitary conditions due to improper waste management. Modern sanitation and sewage treatment greatly reduce risks associated with human waste, which is a major factor in the spread of communicable disease. However pathogens such as bacteria, viruses or protozoa are also found in food and other organic solid waste. Insects and rodents can directly or indirectly transmit these disease agents to humans if solid waste is not controlled. Uncontrolled burning of waste can also transmit these agents by air.

Residential wastes are generally collected weekly by the municipalities. This residential waste is disposed of primarily in sanitary landfill sites where proper management controls the immediate biological hazard. Long-term hazards from decomposition of wastes and the generation of methane gas and leachate within the landfill are discussed in Section III.C.2.1.

2) CHEMICAL CONTAMINATION: Proprietary chemicals are a relatively small component of solid waste. However, they have a disproportionately large effect on the environment. Chemicals contained in household and industrial products have in the past caused major environmental health problems by contaminating surface and ground-water after landfilling or careless dumping on the ground (See Section III.C.2.1.1). Efforts to divert household hazardous wastes from regional landfills are now under way (See Section III.C.2.4.2.3). Improper disposal of industrial chemicals causing environmental contamination is an offence under many federal, provincial and municipal laws. Land disposal of industrial chemicals is not permitted within the RMOC and this topic will not be discussed in this report.

In the past improper chemical disposal contaminated soils, and this is discussed in Section III.C.6. Other sources of chemical pollution include snow disposal, tire fires and PCBs. Heavy metals and salts found in snow can contaminate water and soil (See Section III.C.4). Tires are a major fire hazard if stored improperly (See Section III.C.3). This problem can no longer be ignored as tire fires near Toronto and Montreal polluted air, land and water in the surrounding area. The disposal of PCBs is discussed in Section III.C.5.

3) PHYSICAL HAZARD: Another health hazards from solid waste is physical injury from improperly disposed of broken glass, sharp metal or other objects. This can be a occupational hazard for garbage collectors and landfill operators.

4) PSYCHOLOGICAL PROBLEMS: If solid waste is not controlled properly, it litters the environment and becomes an aesthetic problem. Individuals losing the pleasure of an area in effect lose the part of the environment that contributes to improved emotional and physical health (See Section III.B). Anxiety and depression can also result from living in a dirty environment, from the threat of devaluation or destruction of property, and from living close to a landfill site.

C.2 LANDFILL SITES

Sanitary landfill is the primary disposal method used by the Region. It involves spreading solid waste on land in thin layers, compacting the waste to the smallest practical volume and covering it with soil at the end of each working day.

Many of the sites now closed were operated as unplanned and unstructured solid waste sites. These open dumps were often located in the bush out of sight or in old gravel pits that were used to dispose of garbage from nearby villages. Accumulated waste was reduced through burning. As the waste was not covered, there were often fly, odour and rodent problems associated with them. In the early 1970s, municipal dumps were required to apply to the MOE for an operating licence and to change to sanitary methods in order to remain open.

C.2.1 HEALTH HAZARDS ASSOCIATED WITH LANDFILL

Solid wastes degrade chemically and biologically to produce solid, liquid and gaseous products. Factors affecting decomposition of waste include the mix of waste, the physical, chemical and biological properties, oxygen and moisture content, temperature and microbial population.⁶⁸

The three major health concerns associated with abandoned landfill sites are:

- 1) leachate contamination of surface and ground-water and wells - usually a rural problem
- 2) methane gas production - usually a problem in built-up areas
- 3) soil contamination by hazardous waste - becomes a problem when land is used for another purpose (See Section III.C.6)

Current legislation and design criteria aim to eliminate or control these problems in active sites.

C.2.1.1 LEACHATE

Leachate is produced when surface water percolates through landfill, extracting microorganisms and water-soluble chemicals from the solid waste. The resulting acidic chemical mixture has high levels of iron, zinc, nickel, phosphates, sulphates, chlorides, sodium, nitrogen, ammonia, and is also high in hardness, suspended solids, Biological Oxygen Demand and total solids. Leachate can also contain toxic organic and inorganic chemicals that have been thrown away. If the ground under the landfill is permeable, the leachate will enter an unconfined aquifer, contaminating it. Following the water flow, the leachate will slowly spread throughout the aquifer in a plume. The leachate can also come back to the surface in springs or enter a confined aquifer through fissures in the impermeable layer. In the past, the geology of the land beneath a landfill site was not a consideration in site selection and this created the potential for many contaminated aquifers.

The potential impact of leachate depends on other factors such as the amount of precipitation and surface drainage of the site, the permeability of the soil, and hydrogeological characteristics of the site. Leaching is best controlled with proper site design. Site selection is very important; a good site is situated above the 100-year flood plain, away from bodies of water, above the water table and on soil

with poor permeability. An impermeable liner of naturally occurring clays, soil cement or artificial materials in the bottom of the landfill will limit leachate from moving into the water table. When the site is filled up, it should be covered with a low permeability cover, graded to shed rainwater, melting snow and surface water, and planted with grasses to prevent erosion. Leaching in existing landfills can be controlled by building leachate collection systems around the perimeter of the site. This technique is used in several active sites in the Region (See Section III.C.2.3).

When landfill sites also contain hazardous waste, the problem can be compounded. This happened in the City of Gloucester (Table XIII, site number 23) when the municipality leased 6.5 hectares of land from Transport Canada for a municipal landfill site between 1957 and 1974. The 12 ha area contained 220,000 tonnes of domestic garbage at the time of closing. From 1969 to 1980, 0.15 m² of this site was designated as a "special waste site" for disposal of chemical wastes from federal agencies and laboratories. It is now one of six Priority I waste sites owned by the federal government.⁷⁰

Investigations in the late 1970s and early 1980s indicated that the site had contaminated local ground-water with organic chemicals.⁷¹ Two plumes, one in the shallow, unconfined aquifer emanating from the municipal site and a second originating from the special waste site in a deep confined aquifer were defined. The water flow in these aquifers is easterly, towards an industrial park and residential area.

Transport Canada has provided municipal water to occupants in this area. Pockets of toxic waste and contaminated soil has been removed from the site. The leachate plumes in the confined aquifer have been located and remedial treatment is in progress.

C.2.1.2 LANDFILL GASES

In the early stages of a landfill when oxygen is present, carbon dioxide is produced by microbial decomposition of the waste. When the oxygen content is depleted, microbial decomposition changes and methane and carbon dioxide gases become prevalent. The rate of methane production depends on the type of waste, temperature within the landfill and moisture content; methane generation can continue for up to 100 years after closure.

Before the 1940s, waste in landfills was burnt periodically; any remaining ash does not present a problem for methane gas. Organic material has now been decomposed and methane gas is no longer being generated. However, in the 1950s and 1960s, burning of waste was not a popular option in the city and sites filled in this era have a greater potential for methane gas production.

Methane gas is lighter than air and, in suitable conditions, escapes the waste site. This migration is facilitated by certain geological settings and the permeability of the materials confining the waste. As methane gas is explosive in concentrations between 5-15%, a dangerous situation may develop if methane gathers in poorly vented enclosures. Methane can enter buildings located near a methane source through cracks in foundations or can be trapped underground in the sewage system. Methane gas is not a respiratory hazard when it is diluted in the atmosphere. It can be when it is confined in a building or other closed area. Other landfill gases such as benzene and toluene from contaminated soil are known carcinogens.

The health impact of landfill gas production can be controlled by installing a ventilation system

around the perimeter of a landfill site to prevent lateral migration of gas, or by installing gas vents directly through the cover of a closed landfill. The impermeable covers required to prevent leachate production can actually promote methane gas problems if vents are not installed.

Methane gas is not a problem in closed landfill sites that are isolated from development. However some closed rural landfills that were once remote are now within rural subdivisions and require evaluation. The many closed landfills within the greenbelt area and that are either near or under residential areas are potential problems. The City of Ottawa located and tested abandoned landfill sites (Table XII) to determine potential methane gas concerns.⁷² Remedial action recommended for these sites has been carried out.⁷³

C.2.2 INVENTORY OF INACTIVE LANDFILL SITES

As a means of developing an orderly approach to the investigation of all sites, an internal MOE waste disposal site classification scheme has been developed. This classification system identifies two basic types of sites⁷⁴:

- 1) **CLASS A:** Sites deemed to have the potential to have an impact on human health.
- 2) **CLASS B:** Sites deemed to have the potential to affect the environment in general.

Sites are deemed hazardous to humans if any of the following criteria hold:

- 1) existing dwelling/structure on site
- 2) private or municipal well less than 1000 m from the site
- 3) stream within 1000 m of the site and there is known domestic consumption or in-stream use within 5 km downstream
- 4) likely future development of land in urban area, or located in a developed rural area
- 5) significant aquifer at or within 10 m of surface and ground-water movement is downward
- 6) past problems at site

A site that does not satisfy any of the "Class A" site criteria is automatically a "Class B" site. These sites can be further classified if the type of waste and age of site is known. This classification is given for inactive sites in Table XI.

Table XI MOE Closed Waste Disposal Site Classification

Waste Type	Location	Years Closed	Class A (Humans)	Class B (Environment)
Industrial Liquid /Hazardous Waste	Urban	NAP	A1	B1
	Rural	NAP	A2	B2
Municipal /Domestic Waste	Urban	< 10	A3	B3
		10-20	A4	B4
		> 20	A5	B5
	Rural	< 10	A6	B6
		10-20	A7	B7
		> 20	A8	B8

NAP - Not applicable

For municipal/domestic waste sites, the date of closure of the site is important as the rate of leachate and gas production declines with the age of the landfill. For industrial liquid /hazardous waste, because of the high initial concentrations and often low solubilities, leachate and gas production can be maintained at levels of concern for a longer period of time. If a domestic/municipal landfill has been closed for at least ten years, and there have been no methane-related concerns, then it is assumed that, unless the site's environment is significantly changed by development, these concerns will not arise in the future.⁷⁴

The inactive landfill sites within the Region that are known to the Health Department are listed in Table XIII and Table XII. As environmental impact studies are rarely done on old sites until a problem is recognized, the extent of environmental hazard associated with old dumps in the RMOC is not known. Many of these inactive sites were closed prior to the enactment of legislation in 1971 requiring the issuance of a Certificate of Approval for the operation of a waste disposal site. As a result, data is not always available on the waste type and physical setting of these old sites. Much additional work is required to ensure that information is on file for all waste disposal sites in the Region. Information sources include MOE data files on individual sites, file archives and field inspections of the sites.

C.2.2.1 INACTIVE LANDFILL SITES WITHIN THE CITY OF OTTAWA

The landfill sites located by the City of Ottawa are listed in Figure 27, Table XII. Landfilling in this urban area stopped in the mid 1960s. Most of these areas are now parks or vacant land. Another site was discovered in Vanier adjacent to Landry Street in July 1990 during an environmental assessment conducted before developing the site (See Section III.C.6.4). In the fall of 1983, the City of Ottawa located the minutes of a council meeting outlining waste disposal practices between 1906 and 1945 that identified 16 other potential sites.⁷⁵ Since that time, additional research located 7 more waste sites.⁷⁶ All have been evaluated for potential environmental or health impact and remedial action has been taken if deemed necessary.

Figure 27 Inactive Landfill Sites within the City of Ottawa



Table XII Inactive Landfill sites within the City of Ottawa

Site No.	Location	Size (ha)	Operation Date	Other Information
1	Pinecrest & DuMaurier	4.1	Nov 1953-May 1957	1; 3; Church and houses constructed within landfill
2	Parkway near Richmond Road	3.7	Apr 1957-Jan 1950	1; 3; 4; 60 m to highrise
3	McBride & Raven	4.1	Dec 1950-Nov 1953	1; 3; 4; 30 m to housing and stores
4	Larose & Larkin	1.2	approx 1947	1; 2; 3; 4; 30 m to houses
5	Bayview & Slidell	7.3	1933-1946	1; 3; 100m to Ottawa River; City of Ottawa Works building
6	LeBreton Flats	7.9	Mar 1963-Feb 1964	1; adjacent to Nepean Bay, vacant
7	Bronson at Carleton University	7.3	1930's-1946	1; 3; Football field and parking lot
8	Brewer Park	NA	Approx 1933	3; arena and pool on site
9	Kilborn & Bank	0.2	May 1947-Oct 1947	1; 3; Paved area, school on site, 80 m to Sauniell Creek
10	Riverside Drive	97.2	June 1948-Mar 1963	1; 3; 4; 30 m to school, other structures nearby
11	Riverside Drive near Dale Ave	1.5	1954-1957	1; 2; 3; 30 m to school, apartment bldg on site
12	Lees Ave, Algonquin College	5.2	1933-1947	2; Extensively developed, 100 m to Rideau River
13	Riverside & Queensway	1.5	1964-1967	100 m to Rideau River; 200 m to RCMP HQ; vacant land
14	Notre Dame Cemetery	11.3	1952-1953	1; 3; Homes and businesses border site
15	Billings Street Dump	0.2	1945-1950	1; 30 m to apt bldg, 100 m to Ottawa River, Undeveloped land
16	Hare & Kingsmore	0.2	1945-1950	1; Private land
17	Chamberlain & Lyon	NA	1920-1930	2; Vacant land
18	Sherwood Drive	NA	before 1945	1; Not located
19	McRae Street	NA	before 1945	1; Not located
20	Capital Park (Craig Street)	0.2*	before 1924	4
21	Commissioner Park at Carling Ave	6*	before 1934	4; near Dow's Lake, parking lot

1 organic waste; 2 burnt wastes or rubble; 3 methane hazard potential; 4 Currently used as parkland.

* size estimated from map

Table XII continued. Inactive Landfill Sites within the City of Ottawa

Site No.	Location	Size (ha)	Operation Date	Other Information
22	Central Park	5*	before 1925	4; mature trees
23	Rideau River, Keefer to Dufferin	1.5*	before 1925, 1928-38	2; 4; part of Stanley Ave
24	Rideau River, Union to Victoria	1.5*	NA	2; 4
25	Rideau River, St. Patrick St. Bridge to Cummings Bridge	4*	before 1928	2; 4
26	Ottawa River, Kerr to Bank St.	0.2*	1922-25, after 1944	parking lot
27	N Rideau River, Near Bank St	1.3	NA	Lanadowne Park
28	Lees Ave (west of site 12)	4.5	1928-38	2; 4; playground, housing
29	Maple Island (Minto Bridge)	1.5*	before 1928	2; 4
30	Porters Island	4*	before 1928	2; retirement home, apt bldgs
31	Sherwood Dr., Carling to Irving	7*	1924-28	2; buildings
32	Rideau River, Carleton University to Brewer Park	7.8	before 1928	2; sports fields, some housing
33	Warrington Dr., Wendover to Billings Bridge	0.1*	before 1928	4; housing
34	Rideau River, Cathcart to St. Patrick	0.1*	before 1928, after 1945	2; 4
35	Windsor Ave	0.1*	before 1928	2; parking lot
36	North of Lees Ave	8*	1928	2; 4
37	King Edward & York, SW corner	0.1*	1925	Coal tar plant, now Environment Canada
38	Laroche Park, Attonchurst & Bayview Ave	0.2*	1928	2; 4, old sewage lagoon
39	Sussex & John, SW corner	NA	NA	4; homes
40	Henderson & King Edward	1.4*	1928	sports field, University of Ottawa
41	Bayswater & Wellington	0.1*	1928	no available information
42	Yonge & Fairmont	0.1*	1928-1932	no available information
43	Merivale & Baseline, NE	NA		AgCan disposal site for pesticides wastes, no environmental impact

1 organic waste; 2 burnt wastes or rubble; 3 methane hazard potential; 4 Currently used as parkland.

* size estimated from map

C.2.2.2 INACTIVE LANDFILL SITES OUTSIDE THE CITY OF OTTAWA

The rural sites that have been classified are listed in Table XIII. All sites located in urban areas are automatically considered Class A sites. This data base is continually being updated and verified by the MOE. Although some of these sites have not been used since the early 1980s they are currently in the process of officially closing site numbers 2, 7, 18, 19, and 20. As of 1988 these sites are still classified as active sites.

The inactive waste disposal sites located outside of the City of Ottawa⁷⁷ (Figure 28, Table XIII) were either old dumps or areas filled with light industrial wastes and earth for the purpose of reclaiming unsuitable land for development. Many of the dumps are closed and are very old with little documented history. Few sites have been studied for environmental impact. They are considered remote from developed areas and are now used as vacant, agricultural or reforested land. However, as developments requiring private ground-water supplies are built near them, potential contamination of ground-water can become a health concern (See Section III.C.2.1.1).

Figure 28 Inactive Landfill Sites Outside the City of Ottawa



Table XIII Inactive Landfill Sites Outside the City of Ottawa

Site No.	Municipality	Lot	Concession	Size (ha)	Date Closed	MOE Classification	Other Information
1	West Carleton	6	5	8.12	Aug 26, 1981	NA	Torbolton, capped 1990
2	West Carleton	21	6	0.81	mid-1980s	A3*	Galletta, capped 1990
3	West Carleton	12	2	NA	1971	A	Opposite proposed housing site
4	West Carleton	21	3	NA	no record	NA	Huntley, pasture, remote
5	West Carleton	12	11	NA	Aug 28, 1974	B	NA
6	Kanata	10	2	NA	Nov. 31, 1974	A6	March
7	Nepean	9	4	29.9	1979	A*	Nepean, former Regional site
8	Nepean	15	5	NA	1965	NA	Moodie Drive pit
9	Nepean	34	3	NA	1958	NA	Bruce pit, owned by Ministry of Transport
10	Nepean	27	5	NA	1958	NA	NCC Greenbelt
11	Goulbourn	16	10	20.25	May 1, 1982	A4	Bush and swamp
12	Goulbourn	18,19	10	NA	1962	NA	Stittsville, vacant field
13	Goulbourn	15	3	NA	1971	NA	NA
14	Goulbourn	18	4	NA	1973	NA	Richmond
15	Goulbourn	17	5	NA	Active late 1970s	NA	Uncertified Landfill
16	Goulbourn	22	7	NA	Active late 1970s	NA	Uncertified Landfill
17	Rideau	31	2	NA	Oct. 15, 1972	B6	North Gower, vacant agricultural
18	Rideau	11	3	5.14	mid 1980s	B4*	Marlborough, bush
19	Osgoode	26	2	6.25	mid 1980s	B4*	Osgoode, vacant land, leachate present

NA - not available; * - see section C.2.3

Table XIII continued. Inactive Landfill Sites outside the City of Ottawa

Site No.	Municipality	Lot	Con.	Size (ha)	Date Closed	MOE Classification	Other Information
20	Gloucester	13,14,15	1	NA	1989	A*	Digested sludge at R.O. Picard Environmental Centre
21	Gloucester	5	6	7.6	Dec 31, 1981	NA	NA
22	Gloucester	26	4	73.4	Aug 26, 1981	NA	20 m to school
23 i	Gloucester	16	3	12	1974	NA	Municipal dump, owned by Ministry of Transport
23 ii	Gloucester	16	3	0.15	1984	A1	Chemical dump in corner of 23i until 1980
24	Gloucester	19,20	3	NA	July 12, 1977	A3	NA
25	Gloucester	25,26	3	NA	Active late 1970s	NA	Old quarry
26	Cumberland	22	1	NA	July 1, 1977	A6	NA
27	Cumberland	9	3	NA	July 15, 1974	B	Remote site
28	Cumberland	19	4	NA	Dec 15, 1975	B6	200 m to Bear Brook
29	Cumberland	10	3	NA	1966	A	Vacant pit
30	Cumberland	5	4	NA	Active late 1970s	NA	NA
31	Cumberland	22	6	NA	1976	NA	Small remote site
32	Cumberland	24	8	NA	1976	NA	Reforested
33	Cumberland	21	9	NA	no record	NA	Remote site
34	Cumberland	22	5	NA	1964	NA	Vacant pit
35	Cumberland	24	A	NA	1976	NA	Private contractor
36	Cumberland	10	6,7	NA	1969	NA	Remote site

NA - Not available; * - See Section C.2.3

C.2.3 CURRENT STATUS OF ACTIVE LANDFILL SITES

The five active landfill sites in the RMOC are operated as sanitary landfills. Solid waste is spread on land in thin layers, compacted to the smallest practical volume and covered with soil at the end of each working day. This alleviates many of the problems associated with open dumps. These sites are listed in Table XIV along with MOE classification and waste content as of 1988 (when the last MOE Inventory was published) and client municipalities. The MOE Classification of active sites is explained in Table XV. None of the five sites accept hazardous waste.

Table XIV Active Landfill Sites in RMOC

	Trail Road	Laidlaw	Almonte	Huneault	Springhill
Owner	RMOC	Laidlaw Waste Systems Inc.	Town of Almonte	Numbered Company	Osgoode Township
Location	Nepean	West Carleton	West Carleton	Gloucester	Osgoode
Lot	7,8,9,10	4	14	3,4	31
Concession	4	3	7	4	6
Date Open	1979	1968	1972	1960	1950s
MOE Classification	A4	A3	B4	A3	A2
% Waste Type (as of 1988):					
Domestic	70	21	60	5	80
Commercial	22	64	20	NAP	10
Other	8	15	20	95	9
Liquid	NAP	NAP	NAP	NAP	1
Client Municipalities	Gloucester Ottawa Nepean Rideau Rockcliffe Park Vanier	Kanata Cumberland West Carleton Ottawa*	Town of Almonte	Light Industrial	Osgoode

* Apartment and Multi-Unit dwellings only; NAP - Not applicable

Table XV MOE Active Waste Disposal Classification

Waste Type	Location	Class A (Humans)	Class B (Environment)
Industrial Liquid /Hazardous Waste	Urban	A1	B1
	Rural	A2	B2
Municipal/Domestic	Urban	A3	B3
	Rural	A4	B4

The MOE regulates waste disposal sites through the *Environmental Protection Act*. This includes municipal waste disposal sites and any construction/development landfill sites accepting natural materials and construction waste. A Certificate of Approval is required for the operation of these sites. Before a certificate is issued, the site must pass an environmental assessment under the *Environmental Assessment Act*. Operating standards have been raised in recent years to monitor the current situation, anticipate future environmental concerns and plan remedial action to reduce the adverse impact. New landfill sites or old sites applying for expansion are required to meet rigid standards before approval will be granted.

C.2.3.1 TRAIL ROAD LANDFILL SITE, NEPEAN

This 204.5 ha site located in the City of Nepean east of the town of Richmond is bounded by Cedarview, Cambrian and Trail roads (Figure 29).⁷⁸ It has been operated by the RMOC since November 1979 (when the adjacent Nepean landfill site reached its capacity) and has four planned stages in 90 ha. The remaining 114 ha is buffer land.

The first section was filled by the fall of 1986 and capped during 1988. The second stage was filled by early 1991, and filling of the third stage has begun. The life expectancy of the Trail Road site is approximately 10 years - it will be full some time between 2000 and 2001 assuming current filling rates. The exact date depends on our success in developing and successfully implementing a comprehensive Waste Management Master Plan.

With the blue box recycling program in effect since 1987, the volume of household garbage going to the landfill site has been reduced. Other sources such as sewage sludge from the sewage treatment plant and contaminated soil from the underground storage tank replacement program have added significantly to waste volumes.

The Trail Road site is located on a sand and gravel ridge that has an impermeable clay layer beneath parts of the landfill (Figure 30). Two ground-water systems flow above the bedrock layer. A shallow unconfined sand aquifer above the clay layer flows north, and a deep confined sand-and-gravel aquifer is present below the entire site and flows northwest towards a pond on the buffer land east of Cambrian Road. The deep aquifer supplies water for local residents. The surface water flows north towards the Jock River. All of these water sources are monitored routinely for water quality. There is no detectable leachate impact on the Jock River.

Leachate directly under Stage 1 of the landfill is migrating northwest towards the pond. To reduce the formation of leachate from Stage 1 and slow the leachate migration, a plastic cover was installed on top of the landfill. This limits the water entering the refuse, thus reducing the production of leachate. Gas vents have been installed to prevent the build up of methane gas pressure under the membrane. A plastic lower liner and leachate collection system was installed under Stage 3 to further reduce leachate entering the water table. Gas monitors installed around the perimeter of Stage 1 identify areas prone to gas migration.

Gas control systems are in place and will be expanded during 1991 through the installation of a gas-extraction system that will draw the gas out of the landfill site and burn it in a controlled flare. A gas-utilization study is under way to research use of the landfill gas as an energy source.

In 1991, a leachate recirculation pumping station and a gas collection system will be installed in Stage 3 to further isolate leachate from the environment. The leachate system will collect the leachate and recirculate it through the landfill. This will confine and concentrate the leachate and seed the refuse with microorganisms, promoting decomposition.

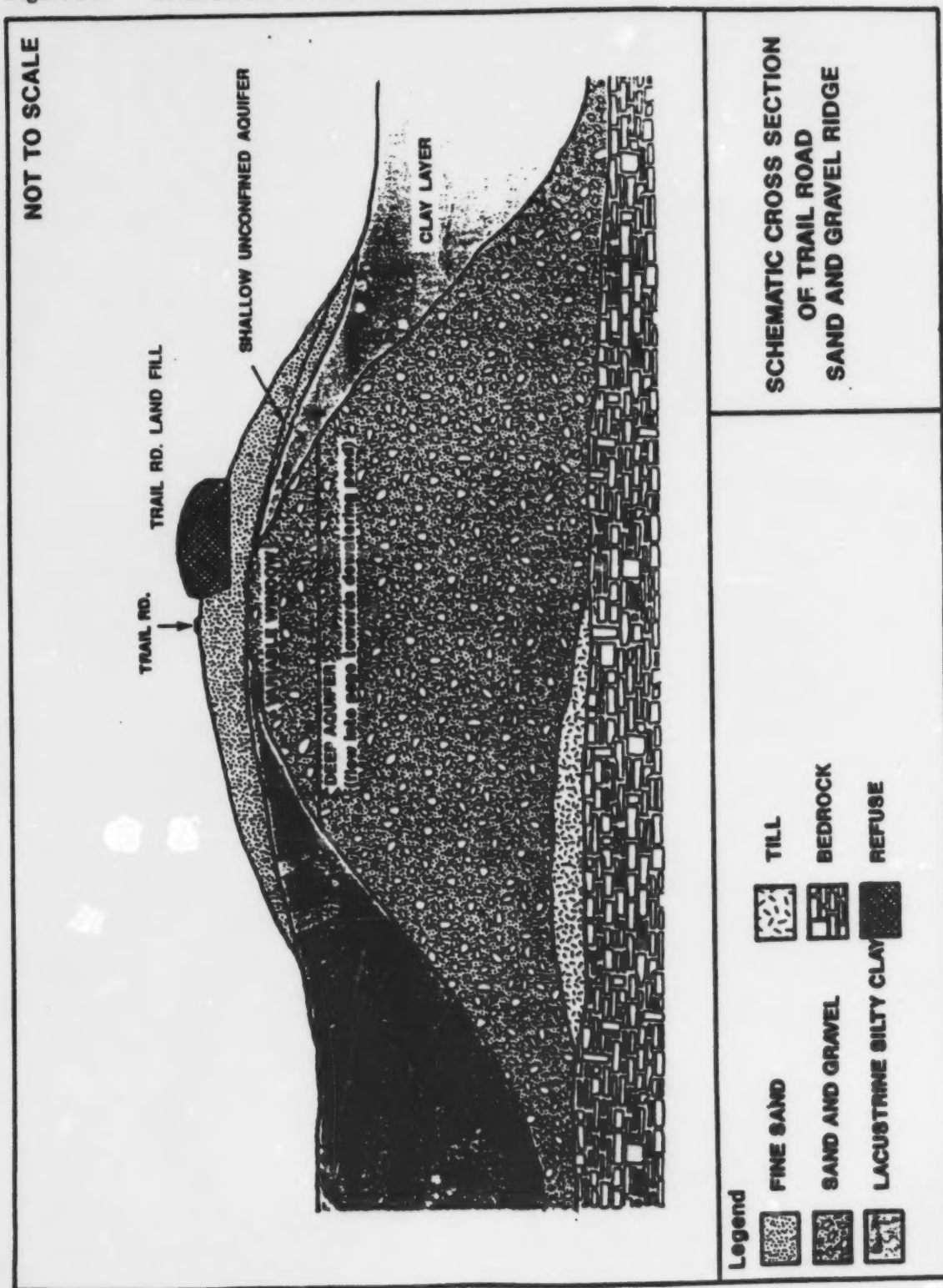
Figure 29 Trail Road Landfill Site



Used with permission of J.L. Richards & Associates Ltd

Figure 30

Cross Section of Trail Road Landfill Site



Gartner Lee Limited

Used with permission of Gartner Lee Ltd

C.2.3.2 LAIDLAW LANDFILL SITE, WEST CARLETON

This West Carleton site, located northwest of the junction of highways 7 and 17, north of Stittsville and 3.5 km west of the Carp River (Figure 31)^{79,80} has been an active landfill site since 1968. It was acquired by Laidlaw Waste Systems Ltd. in December 1987. The total property area is 125 ha with 40 ha currently licensed by the MOE for disposal of municipal solid waste. Based on an October 1990 aerial photography it is estimated that at current practices, the remaining capacity of the site is 13.5 years.

Laidlaw is operating the site under a design and operations plan which has been reviewed by the MOE. An extensive series of site improvements have been completed at the site. These include:

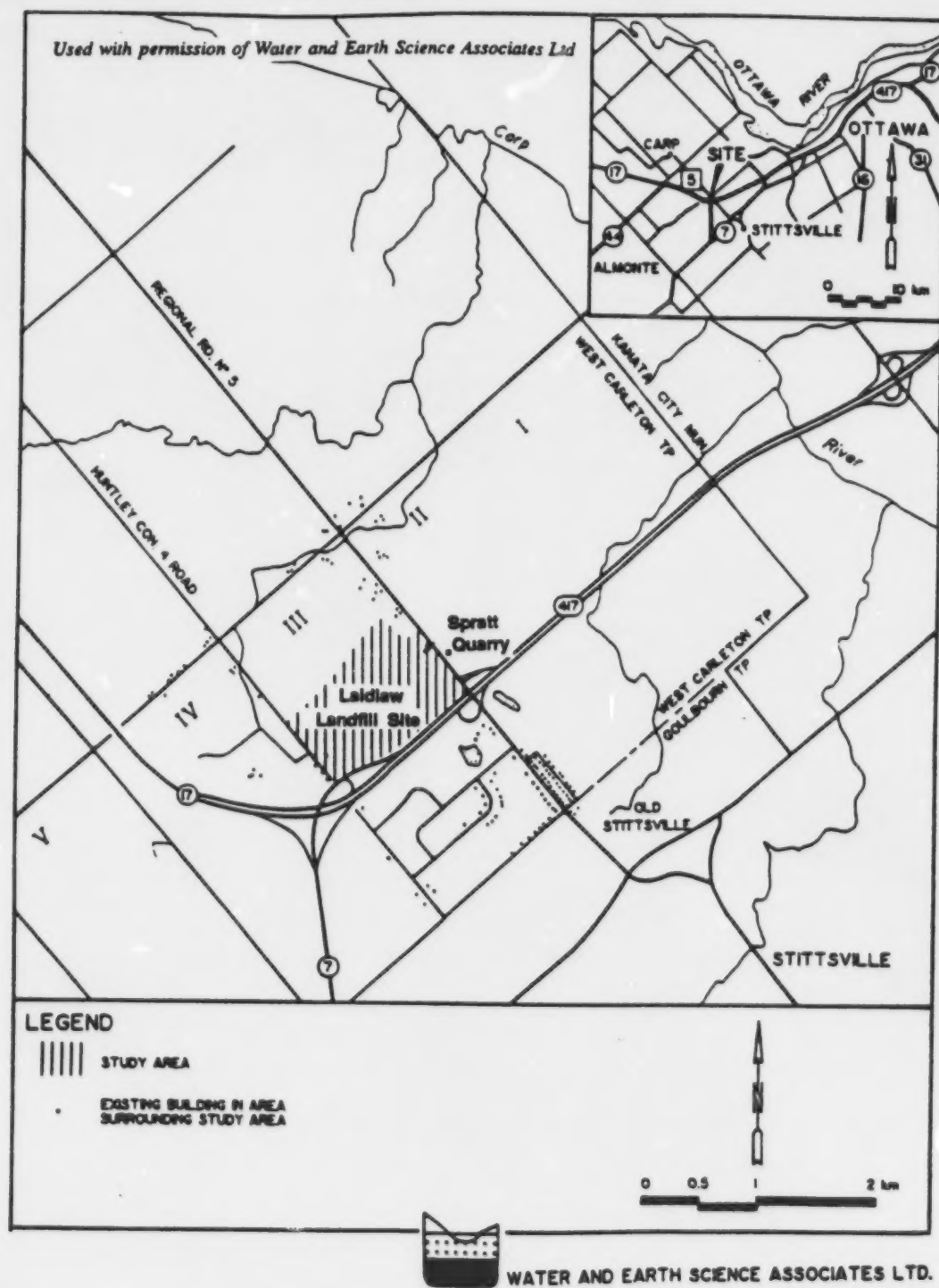
- a fencing, berming and landscaping program
- a litter control program
- the installation of a traffic circulation network on paved roads
- a recycling depot for the local community

The landfill is underlain by sand and gravel, glacial till and bedrock. The sand, surface bedrock and deep bedrock form three aquifers. 40 bedrock wells and 60 well in the surface aquifers are sampled and monitored in the spring of each year to determine if changes in leachate and ground-water chemistry have occurred.

The wells of 18 neighbouring homes have been monitored on a monthly basis to determine if any homes have been contaminated by the Laidlaw site. It has been known for some time that leachate has moved off the site to the west and the well in the Spratt limestone quarry has been affected. Drinking water is supplied to the scale house by Laidlaw. Other wells around the site are being monitored for leachate contamination.

It is the intention of the company to construct a purge well system around the eastern and southern peripheries of the property. The purge wells will be pumped constantly in order to set up a hydraulic curtain in the aquifers beneath the site. This will capture the leachate and prohibit future off site migration. The preferred disposal method is to discharge the effluent by means of a force main into the Regional sewage system near Stittsville. The effluent which will be discharged must meet the standards of the Regional Sewer By-Law which has been revised under the MISA program of the MOE. The purge well system has been designed and is in the approval process at the present time.

Figure 31 Laidlaw Landfill Site, West Carleton



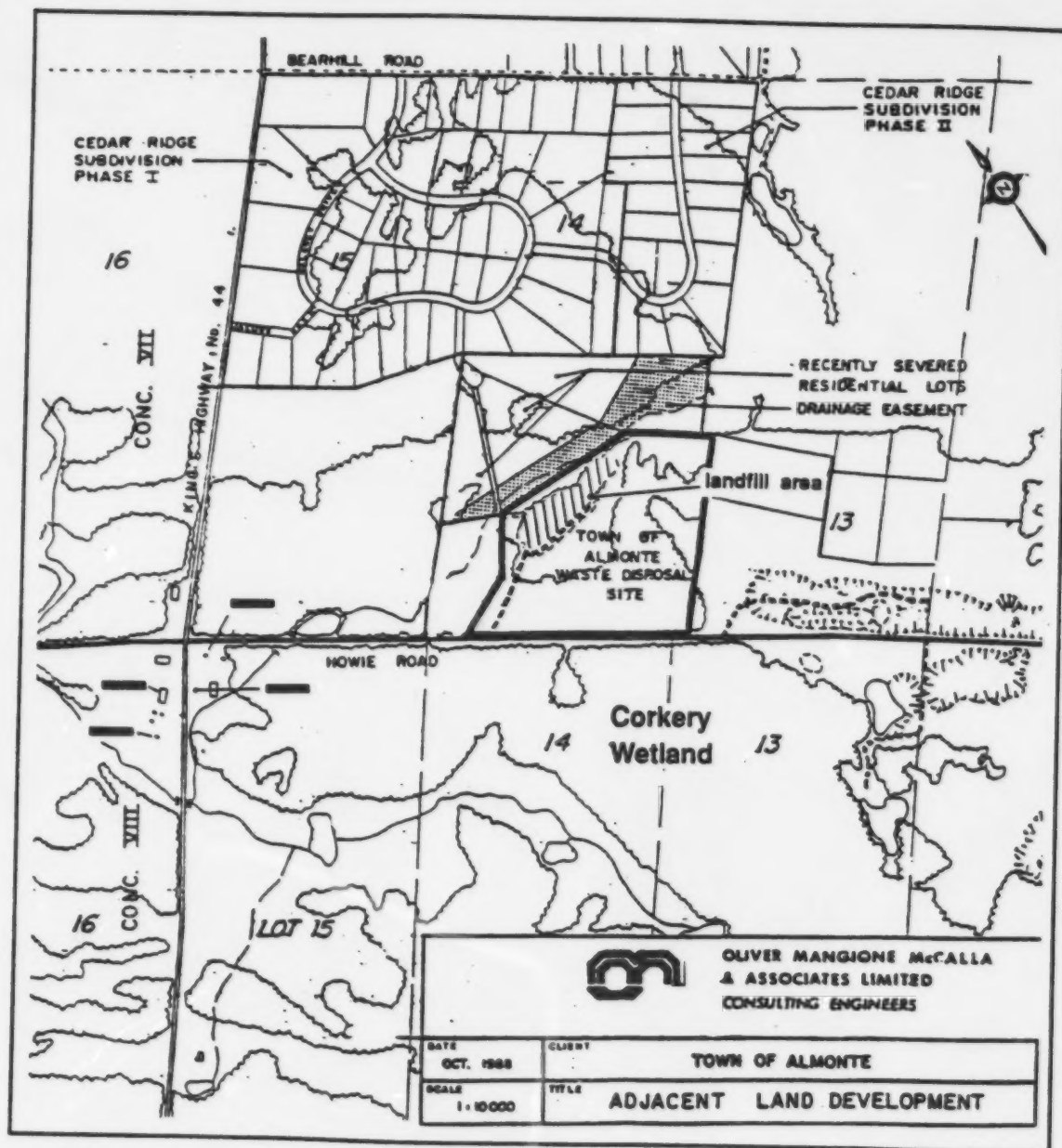
C.2.3.3 ALMONTE LANDFILL SITE, WEST CARLETON

This 19.3 hectare site is located at Lot 14, Concession 7, Huntley Ward, West Carleton Township (Figure 32).¹¹ It has been owned and operated by the Town of Almonte since January 1972 for the disposal of solid municipal waste. Prior to 1985, access to the site was unsupervised. The area north to northeast of the site is zoned residential. Three subdivisions, with a total of 105 lots are serviced by private wells and septic tanks. The area immediately south to southeast is the regionally significant Corkery Creek Wetland (See Section III.D.2.2) The wetland is zoned hazard land and is unsuitable for development due to poorly drained and swampy conditions.

There are two major water aquifers in the area. The unconfined aquifer is very shallow, ranging from 0.8 to 2.6 m below the surface and is not generally used as a source of potable water. The bedrock aquifer is a series of interconnected fractured aquifers within limestone, flowing west away from the housing area and towards the wetland. The surface drainage over most of the site is also directed towards the wetland. From the wetland, the water flows towards the river. A study to determine if there is any connections between the overburden and bedrock aquifers is in progress. This study will determine if there is any potential for contamination of the bedrock aquifer by the landfill site.

A monitoring system to determine the presence of leachate was implemented in 1987. The quality of water in the unconfined aquifer near the site is good. Test wells at the centre and western boundary of the landfill site indicate that there is a moderate degree of leachate present. Further testing is in progress to determine the extent of leachate migration. There is no indication of leachate in the bedrock aquifer which is used as the source of drinking water in the area.

Figure 32 Almonte Landfill Site



Used with permission of Oliver Mangione McCalla & Associates Ltd

C.2.3.4 HUNEALT LANDFILL SITE, GLOUCESTER

This privately owned site located in the City of Gloucester is bounded by Navan Road to the north and the Mer Bleu bog to the south (Figure 33).⁴² It is 4.5 km southeast of Blackburn Hamlet and 5 km west of Navan. This 22 ha site has been operating since 1960 and 40 ha is licensed by the province. It originally served the local community as a rural dump site. Since 1982, only light industrial waste such as construction rubble and inert materials has been accepted by this site. Domestic waste is no longer allowed. The owner has acquired 12 ha of land to the east and west of the site to act as a buffer zone for the watershed.

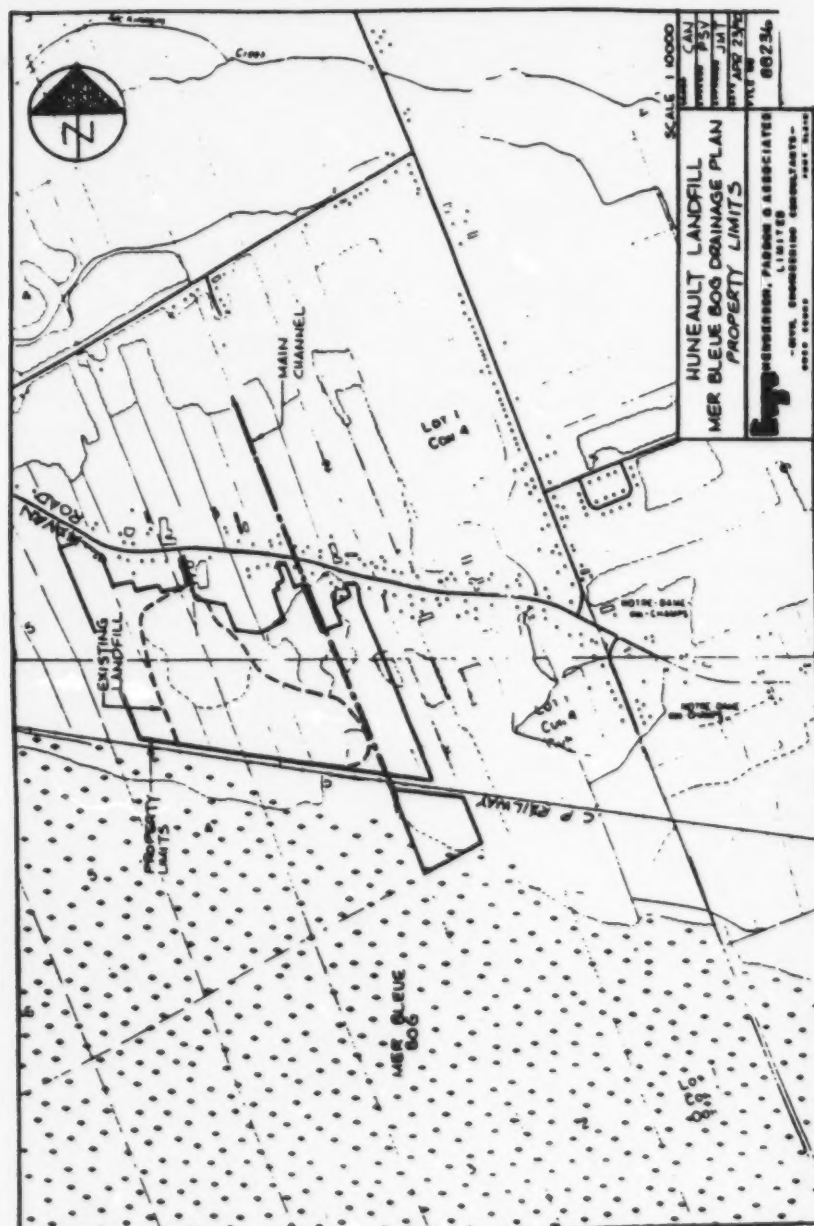
Ground and surface water from the site drains both to the east and west away from the residential development to the north of the site. The eastern flow accumulates at the southeast corner of the site. The western flow collects at the southwest corner of the site and flows west into a marsh and eventually into the headwaters of Green Creek.

A leachate plume from the municipal waste extends across the southern boundary. To contain the leachate, an improved drainage system to interrupt east and west flow, and a leachate collection system around the southeast corner and along the south boundary are proposed (Figure 34). The leachate will be collected at a pumping station, pumped to a holding tank at the northern entrance and hauled by truck to the Robert O. Pickard Environmental Centre for disposal. The owner is waiting for MOE approval to proceed.

C.2.3.5 SPRINGHILL LANDFILL SITE, OSGOODE

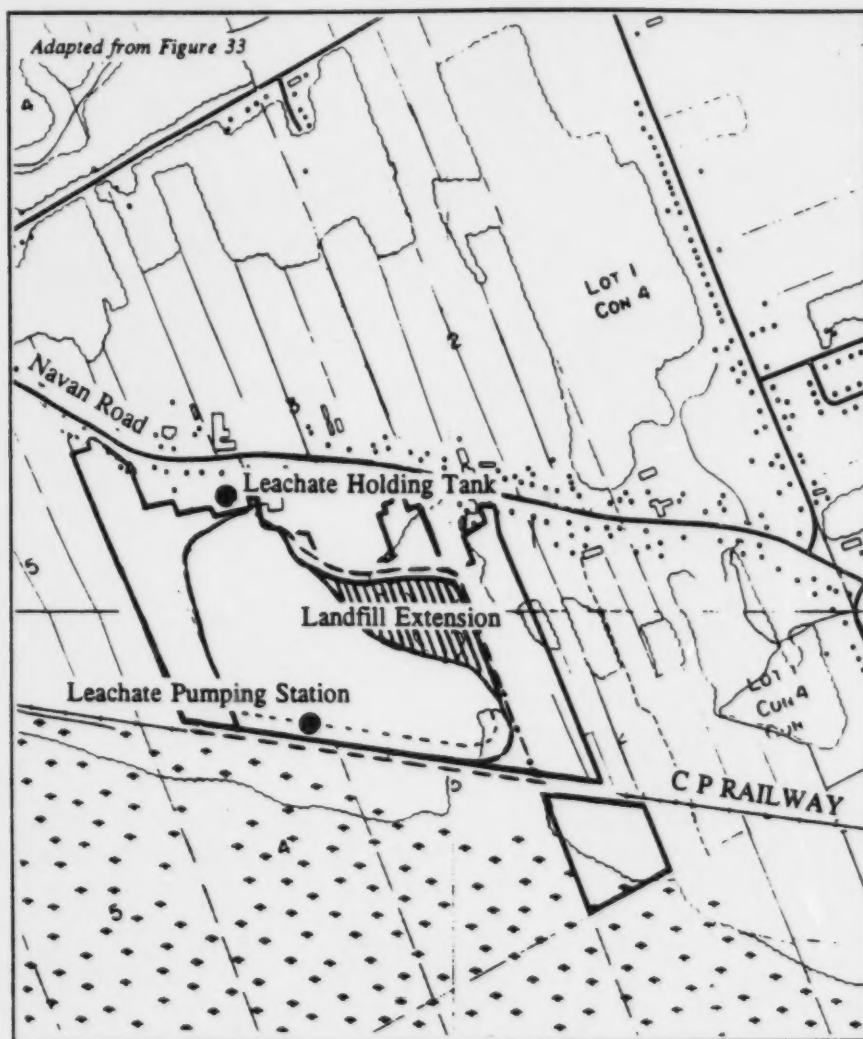
This 39 ha site was opened in the 1950s and is owned and operated by the Township of Osgoode. It accepts domestic and industrial wastes. In the spring of 1990, Osgoode Township received a grant to study the environmental impact of the Springhill landfill site. The consultant carried out the study in the summer of 1990, and the final report was expected in Spring 1991. It has not yet been received from the consultant.

Figure 33 Huneault Landfill Site, City of Gloucester



Used with permission of Henderson, Paddon & Associates Ltd

Figure 34 Proposed Improvements to Huneault Landfill Site



Leachate Collection System - - - - -
 Existing drainage Ditch - - - - -
 Proposed Drainage Ditches

C.2.4 INITIATIVES FOR IMPROVEMENT

The process for dealing with the legacy of past solid waste disposal requires a very different approach than the planning of future solid waste management. Old sites are dealt with through an evaluation process involving inventory, evaluation and remedial action (See Section III.C.2.4.1). Future waste management involves recognition that many wastes can be reclassified as a resource for another purpose. This recognition process (See Section III.C.2.4.2) is usually described as the 4Rs:

- 1) **REDUCE:** Keep materials out of the waste stream by reducing packaging and not using disposable products.
- 2) **REUSE:** Reuse materials for the same or different purposes.
- 3) **RECYCLE:** Collect waste materials for reuse or as raw material for another product.
- 4) **RECOVER:** Extracting materials and energy from waste to use for another purpose such as composting or energy from waste (incineration with reuse of heat).

Those wastes that cannot be reused should be disposed of with minimal environmental impact (See Section III.C.2.4.3). Each provincial government regulates the way regional and municipal governmental within their jurisdiction can dispose of wastes.

C.2.4.1 PAST USE

The MOE maintains a waste disposal site inventory of inactive and active landfill sites. The most current edition was published in 1988.⁷⁴ This inventory and corresponding classification systems was discussed in Sections III.C.2.2 (inactive sites) and III.C.2.3 (active sites).

Independent of the MOE, the City of Ottawa has identified 43 old landfill sites and evaluated them for methane gas hazard potential. Remedial action has been taken where necessary (See Section III.C.2.2.1).

Hydrogeological evaluation of three active sites within the RMOC, Trail Road, Laidlaw and Huneault have been completed. In all three cases, leachate was found egressing from the landfill area. Installation of both a leachate and gas collection system will be completed at Trail Road in 1991. Leachate system have been proposed at both the Laidlaw and Huneault sites and are waiting approval from MOE. Assessment of the Almonte site has been ongoing since 1987. Final recommendations are expected soon. A preliminary assessment of the Springhill site is expected in 1991.

C.2.4.2 WASTE DIVERSION (4R) PROGRAMS

Canadians produce over 30 million tonnes of garbage annually - approximately one tonne per individual per year. One third of this is produced in Ontario. Canada's waste stream has been estimated to be 36.4% paper, 27.6% food wastes and decayable material, 6.7% glass, 6.6% metals, 6.1% yard wastes, 4.6% plastics, 4.3% textiles, 4.2% wood and 3.5% other materials.¹⁰ These figures may change from province to province and city to city.

RMOC's residential waste is probably similar to that of other urban centres, although there may be a difference between rural and urban residential waste. Typical breakdown of municipal solid waste is: 43% residential, 12% construction and demolition, 32% industrial and 13% commercial and institutional. The residential waste composition estimate from a 1989 Montreal audit is given in Table XVI. A waste-stream audit of RMOC began in March 1991. It will focus on industrial, institutional and commercial waste as well as rural and urban residential waste. Each season will be audited. The spring audit is completed and the summer audit will take place in July.

Table XVI Montreal Audit of Residential Waste Stream

WASTE	PERCENTAGE OF WASTE STREAM
Kitchen waste	24.5
Paper	23.8
Yard waste	9.3
Cardboard	7.4
Plastics	6.5
Glass	6.2
Ferrous metal	3.7
Wood	2.3
Aluminum	0.7
Hazardous household waste	0.7
Other (rubber, textiles, leather, appliances, furniture and miscellaneous)	15.0

C.2.4.2.1 FEDERAL PROGRAMS

In 1989 the Canadian Council of Ministers of the Environment adopted a goal to reduce waste generation in Canada by 50% by the year 2000. To meet this objective, Canada has developed a waste management program consisting of the following programs:²³

- Establish standards and regulations to reduce packing material waste by 1993
- Develop 3Rs policies for other components of waste stream by 1994
- Support technological innovations for 3Rs
- Support community action through an expanded Environmental Partners Fund
- Provide information through environmental programs
- Commit federal government to 50% reduction of own waste by 2000
- Expand National Waste Exchange Program to improve market opportunities for 3Rs
- Coordinate federal programs by establishing an Office of Waste Management

C.2.4.2.2 PROVINCIAL PROGRAMS

In February 1991, the provincial government introduced the "Ontario Waste Reduction Action Plan"⁴⁴ with the objective of diverting 25% of Ontario's waste from landfill by 1992 and 50% by 2000. This must be done without diverting waste to incineration. The provincial government plans to use the following approach to accomplish this goal:

- 1) Implement legislation to reduce waste generation at source
 - Mandatory source separation of waste material in commercial, industrial and institutional sectors
 - Mandatory waste audits and waste reduction plans for major users of packing material and for other major commercial, industrial and institutional sectors
 - Mandatory municipal recycling programs
 - Mandatory municipal recycling of leaf and yard waste
 - Consideration of province-wide bans from landfill of corrugated cardboard, wood and drywall, brick and block, newsprint and yard waste
 - Setting tipping fees that represent the true cost of landfill operation
- 2) Develop financial and technological systems to divert waste materials from landfill and into productive use and reuse
 - Enhancement of blue box program
 - Increased provincial subsidy for composters
 - Increased funding for commercial, industrial and institutional sectors to improve recycling programs and to develop markets for recycled materials
 - Simplify environmental approvals for recycling facilities
- 3) Create markets for recycled materials
 - Develop an aggressive marketing strategy for recycled materials to be spearheaded by Ontario Multi-Material Recycling Incorporated (OMMRI): Corporations in Support of Recycling
- 4) Establish public education programs
- 5) Get own house in order
 - Environmental audit and waste reduction program for provincial government
 - Set up waste reduction office to coordinate the preceding programs

C.2.4.2.3 REGIONAL PROGRAMS

The province has set waste reduction and landfill diversion targets of 25% by 1992 and 50% by 2000. To meet these objectives, RMOC is focusing on products that contribute most to the waste stream. As generators of the most waste per capita globally, Canadians must be re-educated to reduce the flow of waste. Educational programs will target the residential, commercial, institutional and industrial waste streams.⁴⁵ The Waste Diversion Branch of the Environmental Services Department is responsible for applying the 4Rs through development of long-term programs to divert waste from disposal. This branch will also develop short-term pilot projects to gain experience both in different waste diversion methods and in implementing public education and liaison programs.

1) HOUSEHOLD HAZARDOUS WASTES: The number and variety of hazardous household products has increased dramatically since the 1950s. Although hazardous household wastes probably comprise only 1% of the Region's waste stream, their explosive, inflammable, corrosive, reactive or toxic properties make them environmentally significant.⁴⁶ Most are harmless when used safely in the home, but many can cause cancer, birth defects, neurological and behavioural disorders, kidney damage, lung and heart diseases, skin disease or poisoning in other circumstances. Improper disposal of these products may contaminate ground-water, poison wildlife, damage sewage systems, harm refuse collectors or contaminate air if incinerated improperly.

A 1987 U.S. survey on hazardous products in the home⁴⁶ found that most homes stored paint products (21.1%), insecticides (13.9%), cleaners (10.5%) and car products (10%). Hazards included inflammability (34%), combustibility (22%), skin and eye irritation (20%) and/or harm or fatality if swallowed (27%). These results are typical of any household.

Earlier attempts to establish a permanent site for hazardous waste collection in the Region were met with a negative public response. More recently, the Region held four very successful household environmental cleanup days in 1989 and 1990.⁴⁷ This participation was greater than at any other similar event in Ontario. Participation increased with each event; from 1700 vehicles in the May 89 cleanup, to 2300 (June 89), 2700 (October 89) and 3700 (May 90). Hazardous wastes collected at three events are listed in Table XVI. At the 1990 event there was a 65% increase over the October 89 event in chemicals collected, a 20% increase in paint, 44% increase in waste oil, 50% increase in car batteries and 100% increase in car batteries. Corrugated cardboard was collected in May for the first time.

Household cleanup days were expensive to run. However, car batteries, waste oil and gasoline, gas cylinders and cardboard were all recycled after the May 1990 event, offsetting part of the cost. In 1991, the Region felt the money would be better used for the development of a permanent site that will be available to the public by the end of 1991.

Table XVII Material Collected at Household Hazardous Waste Days

Waste Material	Quantity		
	June 1989	October 1989	May 1990
Acids (muriatic, sulphuric, etc.)	880 L	1520 L	2320 L
Alkaline (bleaches, drain cleaners, etc.)	1440 L	2160 L	3680 L
Organics (solvents, petroleum, distillates, etc.)	9360 L	12 480 L	18 480 L
Pesticides	1920 L	2320 L	3680 L
Pharmaceuticals	400 kg	1520 kg	1440 kg
Paints and Resins	96 yd ³	137 yd ³	200 yd ³
Automotive Batteries	900	1000	1500
Gas Cylinders	120	140	280
Used Oil	NA	1440 L	5210 L
Waste Gasoline	NA	NA	1512 L
Aerosols	NA	NA	3840 kg
Cardboard	NA	NA	40 ft ³

2) CORRUGATED CARDBOARD: Old corrugated cardboard is a bulky part of the commercial and industrial waste stream, and businesses are being educated how to recycle cardboard. Two private companies operate cardboard bailers and a third is proposed in Kanata. Starting July 1991, loads containing more than 20% cardboard will be charged double tipping fees at Trail Road.

3) LEAF AND YARD WASTE COMPOSTING: By July 1992 the Region plans to ban leaf and yard waste from the Trail Road Landfill site. To make this feasible, it will provide a leaf compost facility by the fall of 1991. Starting in April 1992, yard waste will also be accepted for composting. Leaf and yard waste would be separated at the source by the municipalities and accepted at Trail Road with no tipping fee. The resulting compost would then be available for use by the municipalities. Co-composting with sewage sludge is being studied.

4) INSTITUTIONAL FOOD WASTE COMPOSTING: Significant volumes of food waste are generated by institutional cafeterias and kitchens, hotels and restaurants. A pilot food waste collection system and composting plant is planned by the Region.

5) WOOD WASTE: A pilot program to test collection of construction and demolition wood waste, and methods of wood processing is planned. Ottawa markets for recycled wood will be surveyed.

6) RECYCLING FOR NON-RESIDENTIAL SECTOR: A trial multi-material recycling program to serve the industrial, commercial and institutional sectors in the Region will be undertaken.

7) TIPPING FEES: Companies delivering garbage to the Trail Road landfill site are charged a tipping fee of \$46/tonne. This fee will be increased gradually to encourage diversion of waste. It will become more profitable to reduce, reuse or recycle the garbage than to take it to a landfill. Differential tipping fees are being established for asbestos, contaminated soils, tires, stumps, corrugated cardboard and waste from outside the Region.

8) SINGLE CONTAINER WEEK: This first public education program was held November 12-19, 1990. Its goal was to encourage families to reduce their weekly household waste to one container. First, instructions on reducing waste were delivered to homes via the *Ottawa Citizen* and *le Droit*. A tag, which was also a ticket in a draw for prizes, was provided for attachment to the single container. This education program was not a waste diversion program - it was fully understood that families might withhold garbage until next pick-up day. However, it was hoped that practices introduced during the week might be incorporated into the family routine. Approximately 25 000 families participated in the program and 22 prizes were awarded.

9) TELEPHONE BOOKS: Telephone books are a small, seasonal part of the waste stream but they are visible. The Region offered a telephone book recycling program from January 7 to March 1, 1991, and collected over 190 tonnes of books at a depot provided by the Salvation Army. The books were shredded for animal bedding. The business sector was encouraged to participate, both by recycling used telephone books and by limiting the number of new books distributed within their offices. The municipalities participated through the Blue Box program. Overall response was excellent.

10) THE RE-USE DIRECTORY: This directory for residents lists regional recycling businesses. It encourages recycling and re-use of commodities that would otherwise be landfilled. This project was initiated by the City of Ottawa and will be coordinated and produced by the Region.

C.2.4.2.4 MUNICIPAL PROGRAMS

Municipal waste diversion programs are listed in Table XVIII⁶⁷.

Table XVIII Municipal Recycling Programs

Municipality	Joined Bluebox Program	Items Collected in Bluebox Program	Other Recycling Programs
Cumberland	Sept 1988	1,2,3,4,5	Composters, Xmas Trees
Gloucester	June 1987	1,2,3,5	Composters, Xmas trees
Goulbourn	April 1990	1,2,3,5	Composters
Kanata	June 1988	1,2,3,5	Recycling Depot, Composters, Xmas trees, Leaves, Used clothing
Nepean	June 1987	1,2,3,4	Composters, Education, Xmas trees
Osgoode	Sept 1989	1,2,3,5	No other programs
Ottawa	June 1987	1,2,3,4	Composters, Xmas trees, Leaves, Used clothing
Rideau	Fall 1991	*****	Recycling Depot
Rockcliffe Park	January 1990	1,2,3,5	Leaves
Vanier	May 1991	1,2,3,5	Composters
West Carleton	*****	*****	Recycling depot, Xmas trees, Scrap metal
1 newspaper; 2 glass bottles; 3 metal and aluminum cans; 4 motor oil; 5 clear plastic bottles			

1) BLUE BOX PROGRAM: The blue box program is the best known recycling program in the Region. Ottawa-Carleton has had 135,000 blue boxes in use since the spring of 1987.²² The first municipalities to have this program were the cities of Ottawa, Gloucester and Nepean. Since that time, all but two area municipalities have joined the Blue Box program. This is the largest continuous blue box recycling program in North America.

The blue box program collects newspaper, glass, metal and aluminum cans. Three municipalities also collect spent motor oil. In programs started after 1988, municipalities are required by the province to collect polyethylene terephthalate (PET) bottles. Blue boxes are distributed to 100% of homes with curbside garbage pick-up. Apartment buildings and housing projects inaccessible to recycling pick-up trucks are excluded from the program. A pilot project is currently under way in the City of Ottawa to determine the feasibility of servicing these buildings.

2) RECYCLING DEPOTS: The townships of West Carleton and Rideau have depots instead of the Blue box program. Rideau Township has been piloting two depots which open once a month to receive recyclables and West Carleton has two permanent drop-off depots. The City of Kanata has a recycling depot to service areas where the blue box program is not available.

3) COMPOSTING: Many area municipalities are selling composters through a joint program with the provincial government. Backyard composters are sold to residents at approximately one quarter of the retail cost. Many of the rural municipalities are not involved in this program because their residents are composting on their own, given larger lot sizes. Several municipalities give seminars on using composters.

4) CHRISTMAS TREE CHIPPING PROGRAMS: Most municipalities had some form of tree-collecting program after Christmas 1990. Six municipalities had depots for Christmas trees in early January where residents could drop off their old trees. Others coordinated collecting programs. The trees are chipped for use on nature trails or gardens. Approximately 30 000 trees were collected in the Region.

5) LEAF COLLECTION PROGRAMS: Kanata and Ottawa are the only municipalities in the Region that run a fall leaf collection program for the public. Leaves are collected from the curbside in the fall, and composted over the winter for use in parks the following year. Several other municipalities collect and compost leaves from their own properties (eg. parks).

6) SCRAP METAL: The Township of West Carleton organized a scrap metal collection program in 1990, which was popular among residents.

7) USED CLOTHING: The City of Ottawa picked up used clothing from the curbside in two pilot communities in the city in 1990. Kanata and Gloucester now have depots. The clothes are taken to a distribution centre where they are sorted and bailed for distribution to Third World countries. This program has been highly successful and has plenty of room for expansion.

C.2.4.3 FUTURE DISPOSAL SITES

Regional and municipal governments are now required by the province to plan for management of future domestic and commercial solid waste generated within their boundaries by developing a Waste Management Master Plan (WMMP). The Terms of Reference for WMMPs are contained in Appendix 9 of the "Blueprint for Waste Management in Ontario" released by the MOE in 1984. These terms of reference outline the study goal for the waste management plan, the scope of the study, public participation and the work program.

Waste Management Master Plans are prepared under a program which is funded and directed by the Waste Management Branch of the MOE. The MOE funds up to 50% of a WMMP, and at least two or three municipalities or a Region must be involved in its preparation.

The development of waste management facilities in Ontario is governed by the *Environmental Assessment Act (EAA)* and the *Environmental Protection Act (EPA)*. The EPA controls the design, operation and any environmental impact of waste management facilities. The EAA sets out the planning process for the review and selection of waste management facilities and sites. Therefore, any major facilities such as sanitary landfill sites and energy-from-waste incinerators are subject to a stringent review. If the requirements of the *Environmental Assessment Act* of Ontario are not met, the facilities will not be approved.

The WMMP is organized into three stages: data collection and terrain evaluation, development of master plan options using this data and, finally, formulation of a recommended system for waste management. Essential to all three is the education of the public in better management of their household wastes. The WMMP must propose diversion and disposal techniques that will provide the best option for handling the wastes from economic, financial, social, cultural, technical, land-use planning and natural environmental perspectives.

Traditionally land disposal of solid waste was done by either burning or burying it. The Ontario Government will not consider incineration facilities for domestic waste until the target of 50% diversion from landfill has been met. Therefore at this time landfill is the only disposal technique that can be considered.

Short-term programs exploring ways of applying the 4Rs to meet the provincial government's goal of 50% waste reduction by 2000 are now in progress. However, even if solid waste is reduced, the Region's sanitary landfill sites need to be replaced in the near future. Its 1984 waste management plan tackled such problems as long-term options for permanent domestic and commercial waste disposal facilities.⁸⁹ An interim review of the Regional WMMP in 1989 concluded that the plan would not pass an environmental assessment review under the *Environmental Assessment Act*.⁹⁰ Work on a new master plan began in summer 1990 and should be completed by 1994. Selection of plan consultants and experts began in spring 1991. The new plan will incorporate the best of the previous plan, taking into account recommendations from the interim review.

C.3 TIRE DISPOSAL SITES

In the winter of 1990, the burning of a tire pile containing approximately 13 million scrap tires in Hagersville, Ontario, created extensive air, water and land pollution. This incident illustrates the potential environmental and health hazards of tire piles and has dramatically changed the public attitude to scrap tire disposal.

Each year 7-8 million scrap tires are generated in Ontario (600 000 tires in RMOC) - approximately 1 tire per person. Before the Hagersville fire, 80% were landfilled, 10% were stored in tire piles and 10% were recycled. 1989 tire disposal options for passenger tires in the Southeast Region of Ontario are given in (Table XIX).⁹¹ RMOC population makes up approximately 2/3 of the Southeast Region.

Table XIX 1989 Disposal Options for Passenger Tires

Option	Number of Tires	Percent	Cost (range)
Reuse	107 200	13	-\$10 to -\$50/tire
Retread	0	0	not available
Landfill	605 000	74	\$27 to \$50 /tonne
Stockpile	94 800	12	\$0 /tire
Recycle	0	0	\$0.65 to \$0.90 /tire
Export	0	0	-\$1 to -\$3 /tire
Other	13 500	2	

Total of 820 500 tires generated in Southeast Region in 1989

Landfilling of whole tires has traditionally been a common (due to lack of feasible alternative), but not a satisfactory option. Whole tires are resistant to compaction and take up a large amount of space. Methane gas, given off by decaying wastes accumulates in the tire cavities causing them to float to the surface of the landfill. Stockpiling tires in anticipation of the development of markets for scrap tires is also popular. However tire piles are unsightly, breeding grounds for insects and vermin, and a serious fire hazard.

C.3.1 INITIATIVES FOR IMPROVEMENT

Since June 1, 1989 all new tires have been taxed \$5 plus sales tax (\$5.40). Ontario now has the highest tire tax of any jurisdiction, generating \$40 million annually. The implementation of this tax was motivated by problems created by disposal accumulation of scrap tires. Since the Hagarville fire, the MOE has directed two types of initiatives; tire pile security, management and fire safety, and encouraging productive use of scrap tires.

In November 1989, the MOE formed the Ontario Scrap Tire Task Force in response to initiative from the Rubber Association of Canada and the Ontario Tire Dealers Association. The objective of this task force was to support the development of effective tire management in Ontario.

In March 1990, the MOE announce the Ontario Tire Recycling Program, a five part initiative, initially funded at \$16 million from the tire tax to provide:

- 1) Collection, handling and sorting of tires
- 2) A security program to secure, clean up and eliminate large tire stockpiles
- 3) Development and implementation of processing and recycling technologies
- 4) Research into tire-derived products
- 5) Funds to underwrite the use of recycled tire and rubber in asphalt paving for roads, walks and parking lots

In April 1990, Regulation 309 under the *Environmental Protection Act* was revised to give the MOE additional authority to regulate tire piles and scrap tire facilities. The revisions classifies used tires as "designated wastes" and used tire sites as "waste disposal sites". As of October 1, 1990, tire sites with greater or equal to 5000 tires are required to apply to the Ministry of the Environment for a Certificate of Approval as a waste disposal site. By attaching conditions to the Certificate of Approval including; the number of tires that can be stored at any given time, fire prevention measures, financial guarantees, limitations on the processing and/or disposal methods, the MOE has the same control over disposal of used tires that it does over the disposal of other designated wastes. This additional bureaucracy also serves to discourage the use of tire piles, making recycling alternatives more viable.

Changes to the Fire Code created a special section to deal with tire storage depots specifically to improve enforcement of fire and related measures. These changes included separation into piles of 5000 tires or less (a pile approximately 10 by 10 by 3 m), lanes for vehicle access and water reservoirs for fire fighting.

A Tire Task Force report prepared for MOE in July 1990 listed five sites in RMOC that have accumulated tires either in landfill or tire piles (Table XX).⁹¹ Two sites in Orleans and one in Carlsbad Springs are located in autowreck yards. Laidlaw and Trail Road landfill sites also had tire piles. The MOE has since issued Certificates of Approval to four of these sites. All sites have complied with changes under the Fire Code. 24 hour security was supplied to two of the sites until compliance was completed. Two new sites, located in Osgoode and Cumberland Townships have since been identified and are currently under 24 hour security. Both sites are involved in the MOE certification process.

Table XX Tire Stockpiles in RMOC as of July 31, 1990

Location	Type	Received per Year	On Site July 31, 1990
Carlsbad Springs	Autowreck	4000	35 000
Orleans	Autowreck	10 000	15 000
Orleans	Autowreck	1800	8 000
Trail Road	Landfill	50 000	20 000
Laidlaw	Landfill	35 000	NA

NA - information not available

The MOE has yet to announce a policy for elimination of tire stock piles. Currently, no regional landfill site except Trail Road accepts tires. Because shredded tire is easier to transport to a recycling plant or bury in the landfill, the Region plans to purchase a tire shredder. Environmental Services is preparing to deal with all stockpiles within the Region once a provincial policy is announced.

C.4 SNOW DISPOSAL SITES

Each winter 100 to 450 cm of snow falls on the Region resulting in 1 to 4.4 million cubic metres of snow for disposal. RMOC's policy is to keep all major roads bare to the pavement and all other roads clear of snow. During a snow storm this is done by ploughing all roads and de-icing the major routes.⁹² After a storm, the snow is removed to disposal sites. Only 10% of the total snowfall in the urban areas ends up in disposal sites. The remaining 90% stays on lawns and in ditches, draining directly into stormwater drainage systems when it melts.⁹³

C.4.1 ENVIRONMENTAL IMPACT OF SNOW DISPOSAL

The major environmental contaminants in urban snow are chlorides, sodium, calcium, lead and suspended solids. The major sources of these contaminants are chemical de-icers and automobile exhaust. Table XXI compares the composition of snow in a 1989 study^a with those of a 1973 study.^b The 1989 study showed a significant decrease in chlorides, dissolved solids and lead, and increased suspended solids, Biological Oxygen Demand and alkalinity.

Table XXI Constituents of snow

Analysis mg/L	Freshly Dumped Snow		
	1989 Study ^a		1973 Study ^b
	Mean	Range	Mean
Chlorides ^c	850	140-1500	2500
Suspended solids	2400	1800-3200	1600
Dissolved solids	1900	350-3200	3400
BOD	18	3-26	8.2
pH	7.9	7.5-8.5	6.1
Total lead ^c	0.8	0.4-1.2	3.4

a. Johnston and Droste, 1989; b. Richards, 1973; c. Health affects of salts and lead are described in the water section.

Although chlorine is introduced into the environment from many sources, a major source in the Region is the application of rock salt for snow and ice control. De-icing salt is 94-97% pure sodium chloride. Chloride is not retained by soils and finds its way into waterways. Sodium is more likely to bind to soil, increasing the sodium absorption ratio. The acceptable level for chlorides in Ontario drinking water is 250 mg/L. No adverse effects have been reported up to 600 mg/L for humans. For aquatic life, the toxic level of salt varies with the species. Transportation departments are aware of the environmental impact of de-icers and have minimized the use of road salt as much as possible. This accounts for the decrease in chlorides between the 1973 and 1989 studies.

Lead in snow is introduced primarily by leaded gas and has decreased significantly since the banning of leaded gas. The increase in suspended solids and dissolved solids can be attributed to increased traffic in the urban area.

Contaminants in snow affect the snow disposal site itself and drain into surface or ground-water with snow melt, sometimes decreasing drinking and recreational water quality. Water-insoluble materials can concentrate in the soil to the point where the land must be decontaminated through soil removal before it can be used for other purposes.

In a recent environmental assessment study of Lebreton Flats, one active and one former snow disposal site were selected for assessment.⁹⁶ Both sites exhibit high sodium adsorption ratio (SAR) ranging from 5.03 to 27.25 (MOE criteria is 5). SAR is defined as the relative concentration of sodium to calcium and magnesium content in the soil and reflects the use of deicing salts. When the sodium content of soil is high it displaces the naturally occurring magnesium and calcium in soil, leading to a deterioration in soil structure, decreasing organic content and soil fertility. Sodium ions can also hydrolyse water in the soil, resulting in high pH levels. The average pH levels in healthy soil is 6 to 8. While the active site is within this range, the pH levels in the former disposal site range from 7.5 to 11.18. The soil quality at this site is very poor and vegetation was sparse. High levels of lead were not found in either site. High levels of chloride were found in the ground-water below each site.

C.4.2 INITIATIVES FOR IMPROVEMENT

In Ontario, snow disposal facilities are not strictly controlled, except for direct disposal into water courses, which must be approved by the MOE. Guidelines for choosing new sites have been set out by the Ministry of the Environment in the "1975 Guidelines for Snow Disposal in Ontario".⁹⁷

Snow disposal methods include river disposal, direct sewer disposal, mobile thermal melters and land disposal. Land disposal is the RMOC's favoured alternative. The RMOC also has a pilot project studying the feasibility of direct sewage disposal of snow. The advantages and disadvantages of different snow disposal methods are listed in Table XXII.⁹⁸

In the past, the cost of snow disposal was reduced by using temporary disposal sites that were borrowed, leased or rented on a year-to-year basis. Other sites are operated by area municipalities or leased from the National Capital Commission (NCC). As the urban area grows, disposal sites are located farther and farther from the high-density areas requiring snow disposal, therefore increasing snow disposal costs and spreading contamination over many hectares of land. The RMOC is in the process of establishing permanent sites at Rideau River Park and Conroy Road to replace current

Table XXII Snow Disposal Methods

METHOD	ADVANTAGES	DISADVANTAGES
Status Quo (Change nothing)	• no cost	• land cost increase • ongoing discharge of contaminants • Failure to meet environmental standards • reduced snow disposal threat to public safety
River Disposal (Dump snow directly into flood plain or frozen body of water)	• no cost for land • less equipment needed • dilution capacity of water enhanced by melted snow	• potential upstream flooding /erosion • no control over water quality • discouraged by MOE • accumulation of non-soluble sediments on river bed • visual pollution & poor aesthetics
Direct Sewer Disposal (via a chute into sanitary sewer system)	• low operation cost • lower transportation costs • treatment of suspended solids	• chute plugged by large debris • sewage treatment efficiency reduced by overload • sewer system in growth areas not adequate to accommodate snow
Mobile Thermal Melters (melts snow in area and discharges into sewer)	• low transportation cost • no land costs • treatment of suspended solids	• not compatible with congested streets • operational cost increase • maintenance cost high • cost increases with temperature • requires addition of salt in cold weather
Permanent Land Disposal Site	• debris collected during collection can be disposed of during the natural melt • particulate solids may be trapped on site by impervious soils, reducing discharge of contaminants into water • site selection can minimize noise and aesthetic impact on adjacent lands • sites may be chosen to reduce hauling costs • low operation costs with natural melt	• uncontrolled natural melt can result in contaminants entering ground water • prolonged melting can affect natural habitats • rain can flush residue into nearby water courses • costs to acquire land high • deterioration of melting snow is visually ugly

temporary sites.

The environmental impact of snow sites can be reduced by establishing permanent sites with appropriate controls. Silt clay liners greater than 1 m deep act as impervious layers, preventing infiltration by melt water into the ground-water aquifer. Berming around the site eliminates the visual impact of the site and helps to retain snow and meltwater, preventing leakage into local surface waters.

Studies have shown that retention of snow melt for 24-48 hours removes up to 99% of snow water-soluble pollutants.⁶⁴ Oils and greases that are lighter than water can be skimmed off the surface. De-icers, by their very nature soluble in water, cannot be removed in these ponds. However, controlled entry of meltwater into surface waters can minimize environmental impact through dilution.

An intergovernmental Task Force on Alternative De-icers is exploring development of a biodegradable de-icer to reduce the use of salt and calcium chloride. Such a de-icer will not be technically or economically feasible for some time.

C.5 PCBs

Polychlorobiphenyls (PCBs) are synthetic liquid chemical compounds that were used commercially for over 50 years. Their excellent fire-resistant and insulating properties made PCBs ideal as insulating and cooling fluids in industrial transformers, capacitors and in hydraulic and heat transfer systems. It is estimated that over 40 000 tonnes of PCBs were imported into Canada between 1929 and the late 1970s. Unfortunately, these same properties have made PCBs highly resistant to chemical and biochemical breakdown. In the late 1960s, PCBs came to public attention when their persistence in the environment and bioaccumulation in living organisms became known. The manufacture of PCBs was banned in North America in 1977. This has resulted in a gradual phase-out of PCB-containing equipment with the old equipment containing PCBs being replaced through attrition.

PCBs enter the environment through landfill sites as discarded plastic, paints and electrical equipment, incomplete combustion of PCB-containing wastes, leaks from electrical transformers and capacitors, contaminated recycled oils sprayed on roads to suppress dust, or illegal disposal into sewer systems. The most common route of entry into humans is ingestion of contaminated fish. PCBs may also be inhaled or absorbed through skin.

C.5.1 HEALTH EFFECTS

By 1972, scientists had sufficient evidence that the release of PCBs into the environment posed a hazard to the environment and to human health. Ingestion of 0.5 to 2 grams (g) of PCBs can cause symptoms such as chloracne (severe skin eruptions), increased eye discharge, or systemic gastrointestinal symptoms with jaundice, edema and abdominal pain. Laboratory tests indicate that PCBs can cause cancer in animals, making them suspect carcinogenic agents in humans.⁹⁹ No conclusive, direct relationship between cancer and human exposure has been made.

C.5.2 CRITERIA FOR STORAGE

Once PCB-containing equipment is decommissioned, the PCB waste must be dealt with. In Ontario there are currently no commercial facilities for the destruction of high-concentration PCB liquid or solid wastes. Until such facilities are operational, PCB wastes are stored. If stored properly, using the following criteria, PCBs pose no direct hazard to humans or the environment.

- 1) The storage area must be used exclusively for the storage of PCBs. The site should be free from all fire hazards. Major sites should, ideally, be away from residential areas.
- 2) The storage area must be locked and vandal proof. Ideally, large storage areas should also be adequately fenced or guarded 24 hours per day.
- 3) PCBs should be stored in approved containment drums. If PCBs are stored in transformers, ballasts, etc., a concrete dike with a capacity exceeding the volume of PCBs should be built. Large areas should have emergency spill equipment and spill procedures available.

The list of PCB sites in Ottawa-Carleton is maintained at the provincial level by the MOE. Inspectors from the Ottawa-Carleton Health Department also visit these sites regularly to ensure they are safely maintained following the above criteria. There are presently 34 PCB storage sites in the Region (Figure 35, Table XXIII).

C.5.3 DISPOSAL TECHNIQUES

The technology to destroy PCBs safely is in use in many countries. The best current technology is thermal treatment, such as burning high-concentration PCB liquid wastes in liquid injection incinerators, and burning PCB-containing solids and sludge in rotary kiln incinerators. The first *mobile* PCB incinerator was operational in early 1991, and is being used to eliminate a large PCB stockpile in Smithville, Ontario. Two *permanent* incineration facilities are in the planning stages. The Ontario Waste Management Corporation is planning a hazardous waste facility with PCB destruction capabilities in the Township of West Lincoln, Southern Ontario. This project is currently in the environmental assessment process. The Laidlaw Environmental Services-Hazardous Waste Facility in Sarnia, Ontario is currently planning an expansion. A new incinerator capable of destroying PCBs is included in this proposal.

PCB-contaminated mineral oils can be decontaminated through treatment processes such as chemical dechlorination. In Ontario there are currently four mobile chemical facilities available to decontaminate low-level PCB-contaminated liquids.

Until permanent facilities are built, the bulk of PCB waste will continue to be stored.

Figure 35 PCB Storage Locations in RMO

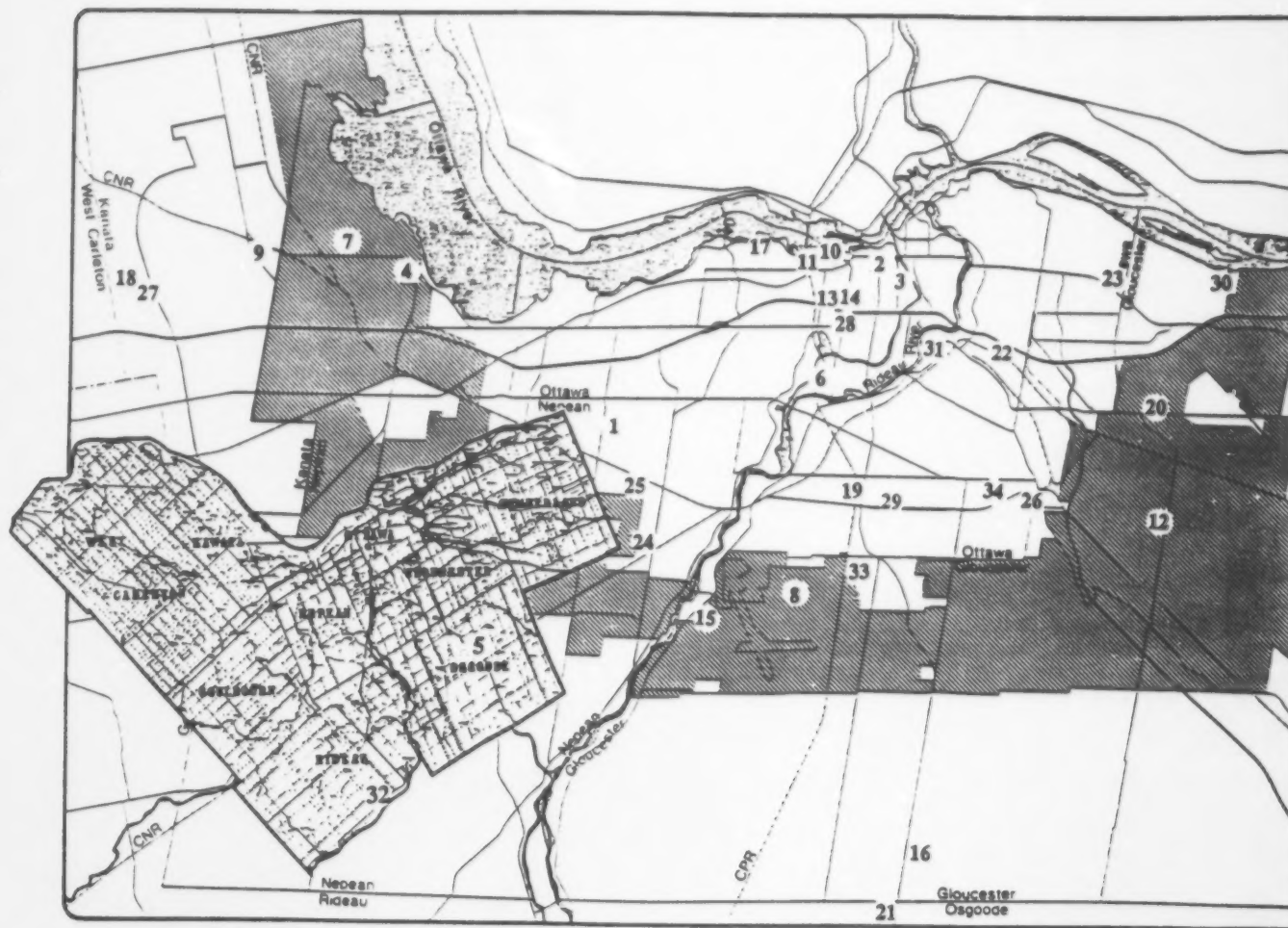


Table XXIII PCB Storage Locations

No.	Company ^a	Municipality	Site Category	Liquid Total ^b (Tonnes)
1	Algonquin College	Nepean	Minor	0.39
2	Bell Canada	Ottawa	Major	5.39
3	Bell Canada (federal)	Ottawa	Minor	0
4	Bell Northern Research	Nepean	Minor	0
5	Bestpipe (Lake Ontario Cement)	Osgoode	Minor	0
6	Carleton University	Ottawa	Major	3.10
7	Department of Communications (federal)	Ottawa	Minor	0.54
8	Department of National Defence (federal)	Gloucester	Major	1.94
9	Digital Equipment of Canada Ltd	Kanata	Minor	0
10	E.B. Eddy Forest Products Ltd	Ottawa	Major	2.29
11	Energy Mines and Resources (federal)	Ottawa	Minor	0
12	Energy Mines and Resources (federal)	Gloucester	Minor	0
13	Energy Mines and Resources (federal)	Ottawa	Minor	0
14	Energy Mines and Resources (federal)	Ottawa	Minor	0
15	Environment Canada (federal)	Gloucester	Minor	0
16	Gloucester Hydro	Gloucester	Minor	0.37
17	Grace General Hospital	Ottawa	Minor	0
18	Kanata Hydro	Kanata	Minor	0.25

a. MOE data base, as of February 5, 1991; b. Sites may also contain transformers, ballasts, capacitors or other PCB contaminated waste.

Table XXIII continued. PCB Storage Locations

No.	Company ^a	Municipality	Site Category	Liquid Total ^b (Tonnes)
19	Liquor Control Board of Ontario	Ottawa	Minor	0.89
20	Ministry of Government Services	Gloucester	Minor	0
21	Ministry of Transportation	Osgoode	Minor	0
22	Ministry of Transportation	Ottawa	Minor	0
23	National Research Council of Canada (federal)	Ottawa	Major	3.25
24	Nepean Hydro Electric Commission	Nepean	Minor	0.13
25	Ontario Hydro	Nepean	Minor	0.74
26	Ontario Hydro	Ottawa	Major	4.65
27	Ontario Hydro	Kanata	Major	1.49
28	Ottawa Board of Education	Ottawa	Minor	0
29	Ottawa Hydro	Ottawa	Major	24.23
30	RMOC	Gloucester	Major	6.11
31	Ottawa Roman Catholic School Board	Ottawa	Minor	0
32	Rideau Correctional Treatment Centre	Rideau	Minor	0
33	Transport Canada	Gloucester	Minor	0
34	Warner's	Ottawa	Minor	0

a. MOE data base, as of February 5, 1991; b. Sites may also contain transformers, ballasts, capacitors or other PCB-contaminated waste.

C.5.4 INITIATIVES FOR IMPROVEMENT

C.5.4.1 FEDERAL

Environment Canada regulates the importation, manufacture, sale and use of any machinery, equipment or product that contains PCBs and monitors the release of PCBs into the environment. Transport Canada regulates their transportation. After an accidental spill involving PCB transformer oil in 1985, the regulations for transporting PCBs were strengthened under the *Transportation of Dangerous Goods Act*.

The *Environmental Contaminants Act* contains three regulations for PCBs: Chlorobiphenyl Regulations No. 1, No. 2 and No. 3. These regulations require periodic mandatory reporting by persons using any equipment, machinery or products containing PCBs, and routine site inspections.

C.5.4.2 PROVINCIAL

The Ontario Ministry of the Environment regulates the storage and disposal of PCB wastes. PCB wastes are defined as any PCB-contaminated liquid, solid, equipment or packaging for which the owner has no further use. An optimal cutoff of 50 ppm was adopted by the United States Environmental Protection Agency and subsequently by Environment Canada and the MOE as a criteria of developing acceptable handling and disposal options. Material containing over 50 ppm is designated PCB waste and requires strictly regulated handling and disposal. Materials containing less than 50 ppm of PCBs pose less hazard and there are several options for their safe handling and disposal.

The *Environmental Protection Act* sets out the requirements for PCB handling, storage and disposal of wastes through the Waste Management-PCBs Regulation 11/82. Two other provincial regulations that concern PCBs are the Mobile PCB Destruction Facilities Regulations and the Waste Management-General Regulations (O.Reg. 309).

C.6 CHEMICAL SPILLS AND CONTAMINATED SOILS

Soil contamination as a result of past land use is becoming an increasing problem in the RMOC, particularly in the urban areas where land once used for industrial purposes is being claimed as residential land. In the past, the discharge of chemicals into the environment was not regulated. Industrial effluent was often discharged directly onto land or into air or nearby surface water. The more enlightened operators contained their chemical waste in storage tanks that they buried on site. The environment was regarded as a renewable resource that could adsorb waste discharge without negative effects through dilution and dispersion in air and water. However, land retains these pollutants through the binding of chemicals to soil constituents, and air and water transmit pollutants through the ecosystem at will.

C.6.1 FORMER INDUSTRIAL SITES

The City of Ottawa has identified 177 former industrial sites where the risk of soil contamination exists.¹⁰⁰ These sites are categorized into three groups according to environmental impact. No other municipality in the Region has completed a comparable study.

1) **GROUP III SITES:** These sites were considered to have a low potential for environmental impact upon excavation and development; 124 sites fall into this category. This group includes railway roundhouses and workshops, foundries, tanneries, dyeing and cleaning works, and some small bulk-fuel storage facilities. Other industries in this category include printing, publishing and allied industries, clothing industries, paper and allied products industries, primary metal industries and fabricated metal industries.

2) **GROUP II SITES:** Soils from these sites should be considered hazardous and subject to chemical analysis before excavation and removal. Evidence suggests that such wastes are present on 18 sites. There is no significant environmental hazard while the site is intact, however excavation and development may result in some environmental risk. These 18 sites include 11 bulk-fuel storage facilities, 3 asphalt plants, 2 government sites and 2 manufacturing companies.

3) **GROUP I SITES:** Five sites contain wastes with high potential for immediate environmental hazard from excavation, and migration of wastes off-site into adjacent surface water. These sites include 2 bulk fuel storage facilities, 2 coal gasification plants and a coal-tar distillation plant. RMOC has already taken remedial measures to clean up these sites.

C.6.2 COAL TAR WASTE

In May 1986, a tar-like substance was found during construction of the Lees Avenue Transitway station. Shortly after, patches of contamination began surfacing on the Rideau River. The source of the contamination was a coal-tar distillation plant operated by Currie Products Ltd at 170 Lees Avenue (1922-1948), with continued use as storage until 1966. Coal-tar wastes were identified in the subsurface of the 1.7 ha area. A subsequent study identified coal tar in soils and ground-water west of and under the apartment building now occupying the site. Coal tar in the soil caused shallow water contamination and was also found adjacent to a storm sewer discharging directly into the river. **Clean-up of the Rideau River¹⁰¹ and remedial action to remove coal tar waste at Lees Avenue¹⁰² have been completed.** Some coal tar remains beneath the apartment building. The site and apartment building are monitored to assess future environmental impact and health effects due to ground and surface water contamination.

Municipal coal gasification plants produced gas from coal for street lights and to heat and light homes. This process generated coal tar waste which was often buried near the plant. Following the Ottawa incident and discovery of a second coal-tar site in July 1986 in Waterloo, Ontario, the MOE began assessing the environmental impact of buried coal waste. A province-wide investigation revealed 41 coal tar sites in 36 communities.¹⁰³ A 1988 inventory of industrial sites identified 44 sites, of which 9 are still active. **Three of the coal tar sites identified in the report are located in Ottawa-Carleton.** The Lees Avenue site, and two office buildings currently owned and operated by the federal government - one on Booth Street and a second on King Edward Avenue.

The original Gas Works Plant in Ottawa was located at the corner of York Street and King Edward Avenue, where synthetic gas was manufactured from coal between 1854 and the 1920s.¹⁰⁴ In September 1986 evidence of the operation was found during renovations to the current building. At this time, extensive air monitoring of the building air for harmful volatile chemicals was conducted and it was determined that there was no danger to the building occupants. PAHs with levels just above the requirements set out in the sewer by-law were detected in the sump water from the building discharging into the Regional sewer system. This problem was alleviated by installation of activated carbon filters and a continuous monthly monitoring program. A daycare located in an adjacent building was inspected by the Health Department. No health hazards were detected. The Gas Works Plant changed owners several times and was relocated to the Rideau River site near Lees Avenue between 1915 and 1922.

The third site of coal tar identified in the Region was at a former fuel-testing station and research laboratory on Booth Street. It was operated by the Mines Branch of the Federal Government between 1911 and the 1940s. Westinghouse was also involved in coal tar production on this site around the same time. The federal ministry of Energy Mines and Resources are still the owners and occupants of the site which accommodate federal offices and laboratories. Assessments carried out at the time of discovery in 1988 determined the potential human and environmental impact was minimal.

Three main classes of hazardous chemicals are found in coal-tar wastes: Polyaromatic hydrocarbons (PAHs), light aromatics and phenolics. Occupational and environmental exposure to volatile parts of coal tar pitch and other PAH mixtures increases the risk of lung, skin and scrotal cancers. Exposure to light aromatics such as benzene, xylene and toluene can cause skin and eye irritation, headache, dizziness, visual disturbances, nausea, fatigue, weakness, unconsciousness and coma. Benzene in particular can inhibit production of red and white blood cells in the bone marrow and in some

cases cause leukaemia, (cancer of the white blood cells). Phenolics such as phenol, cresol and xyleneol can irritate eyes and skin to various degrees with cresol, for example, being very corrosive.

The practical dangers of coal tar waste are handling the product (prolonged contact with the skin), inhaling vapours while the product is being used or undergoing further processing and ingesting it through contaminated drinking water. The risk to the community at large from contaminated coal tar sites in the absence of direct exposure or migration of light aromatics and phenolics through water is very low. The large PAH compounds tend to bind to soil rather than migrate through water. Thorough assessments and continued monitoring of the three known sites in Ottawa-Carleton continue to be carried out by the many government agencies involved.

C.6.3 BURIED FUEL TANKS

Leaks from underground fuel storage tanks pose a real threat of contamination to ground and surface water - a concern to residents who use ground-water as their drinking water supply.¹⁰⁵ One litre of gas can contaminate four million litres of water, rendering it unfit for human consumption. This situation is difficult to monitor because fuel tanks are buried, and often the exact location is not known. Many leaky tanks are often found after contamination has been detected by the presence of gasoline odour in the drinking water supply.

Most of the underground tanks now in use were installed in the 1950s and 1960s and were made of painted or unprotected steel. These tanks have a maximum life of 20-25 years before corrosion and rust penetrates the steel to create a leak. It is estimated by MOE that a large percentage of underground tanks in use in Ottawa-Carleton leak or have leaked in the past. In a recent environmental assessment of Lebreton Flats,⁹⁶ fuel and solvents were found in all ground-water samples. Several industrial sites and gas stations with buried tanks were located in this area.

In the urban area, fuel has contaminated the soil in several sites, and decontamination of some sites is in progress. These are not considered a health problem as the areas are serviced with municipal water and the spills are contained within the boundaries of the sites. Problems may occur when these sites are put to another use.

C.6.4 CONTAMINATION OF SOIL BY LANDFILL

The impact of landfill contamination is discussed in detail in Section III.C.2. When contamination is found during development of a former landfill, it can cause problems for the owner of the site and concern for neighbouring residents. A recent example is discussed below.

In July 1990, routine evaluation of a vacant lot in Vanier bounded by the Vanier Parkway and Landry Avenue revealed high levels of heavy metals. Developers researching the site for development potential found high levels of lead, cadmium, arsenic, mercury, copper, molybdenum, selenium and zinc.¹⁰⁶ The highest levels were found 1 to 2.5 m below the surface. Concentrations found on the surface were within provincial guidelines.⁶⁰

In a typical environmental assessment, researching the history of a property is an important step

in determining potential contamination. A 1932 document from the City of Ottawa archives authorized the City of Ottawa to use the Landry site for "garbage, refuse and ashes."¹⁰⁷ The exact boundaries of this municipal waste site are not known, but are believed to extend into residential areas.

This site is not considered a health risk to area residents as the area is now fenced and the metals are located below the ground surface. If the site is developed and soil is disturbed by excavation, the potential for exposure to contaminated soil exists for both the builders and residents. The owner of the land has retained a consultant company to formulate a strategy for cleaning up the site before development begins. Removal of the contamination will require supervision by the Ministry of the Environment and Ministry of Labour to protect the workers and residents from airborne particulates containing heavy metals.

The MOE is assessing the nearby residential area. Levels of metals at the soil surface can be measured indirectly by measuring the metal content of plants growing in the soil. In August 1990 the MOE collected plant samples from the school and 9 residential properties for preliminary phytotoxicity testing. With one exception, the tests were all below MOE standards. One explanation for finding levels slightly over MOE standards at one property was a recent structural addition to the home. Metals buried beneath the surface could have been brought to the surface during renovations. Further tests in the residential area are being conducted by the MOE.

C.6.5 HAZARDOUS SPILLS

In 1989, 5,345 hazardous spills were reported in Ontario. Most spills averaged 100 litres. Approximately 50% of the spills involved oil or other fuels and 20% involved chemicals. These incidents may include, but are not limited to toxic chemical spills, radioactive materials, explosives, compressed and flammable gases, pesticides and toxic wastes. Specific examples include leaking propane BBQ tanks, gasoline spills from automobiles and punctures to natural gas mains. They are either accidental (car accidents) or deliberate (illegal dumping of chemicals in sewers).

The Regional Emergency Measures Unit coordinates emergency responses in the Region by ensuring the appropriate agencies (fire, police or area municipality) are aware and respond to the emergencies in their jurisdictions. Their involvement varies with the situation, but they follow up on all reported incidents to ensure they were handled properly. The chief role of the unit is to ensure good communication exists at the scene of the emergency, and that the resources are available to those agencies dealing with the situation.

Between January and the end of October, 1990, the Regional Emergency Measures Unit responded to 781 hazardous waste emergencies and 676 motor vehicle accidents involving fuel spills. The number of such emergencies for each municipality is listed in Table XXIV and Table XXV.¹⁰⁸

Table XXIV Responses to Hazardous Material Emergencies in RMOC

Municipality	1987	1988	1989	1990 (October)
Ottawa	NA	376	430	413
Gloucester	NA	NA	68	78
Kanata	36	29	46	NA
Nepean	NA	216	255	223
Cumberland	11	13	19	17
Osgoode	NA	12	7	7
Goulbourn	2	2	1	4
Rideau	4	5	1	2
West Carleton	3	2	3	0
Federal	NA	47	85	37
Total	56	702	905	781

NA - data not available

Table XXV Responses to Motor Vehicle Emergencies in RMOC

Municipality	1987	1988	1989	1990 (October)
Ottawa	NA	355	320	232
Gloucester	NA	NA	57	77
Kanata	15	22	14	NA
Nepean	NA	314	219	221
Cumberland	32	68	88	56
Osgoode	NA	71	62	35
Goulbourn	17	25	26	17
Rideau	17	25	26	17
West Carleton	11	22	43	27
Federal	NA	NA	NA	NA
Total	92	894	840	676

NA - data not available

This information was collected from municipal fire departments, the emergency services most likely to be summoned to a hazardous material incident. The materials involved included inflammable liquids (74%), compressed or liquefied gases (12%), unknown waste products (8%), poisonous oxidizing substances (4%) and poisonous inflammable substances (2%). Damages from hazardous spills range from very minor (repair a leaking propane tank) to serious (removal of large amounts of contaminated soil to a hazardous waste site). The Region does not keep records of the extent of damage incurred from incidents responded to.

C.6.6 INITIATIVES FOR IMPROVEMENT

Canada, like many other countries is beginning to experience the result of past mismanagement of hazardous material and toxic waste. As sources of contamination are discovered, responsible parties or governments have attempted to clean up the contamination. Some provinces have developed guidelines for the cleanup of contaminated sites, but there is no national consistency of approach or designated funding for the cleanup of "orphan" sites.

C.2.6.1 FEDERAL

The Canadian Council of Ministers of the Environment (CCME) has initiated a program to clean up contaminated sites which threaten human health or environmental quality. The National Contaminated Sites Cleanup Program is intended to address the contaminated sites problem with action on several fronts.¹⁰⁹ It is intended to:

- 1) Review and strengthen legislative to ensure that the "polluter pays" principle is respected
- 2) Continue the evolution of an inventory of highly contaminated sites in Canada
- 3) Establish guidelines for the ranking of sites according to their urgency of cleanup
- 4) Provide for the cleanup of orphan sites where the "polluter pays" principal cannot be enforced
- 5) Provide funding for technological advancement in the means by which contaminated sites are cleaned up
- 6) Communicate with stakeholders who are interested in, or affected by, the process and/or who may aid in the process through their input

Beginning in 1990 and for the next five years, \$200 million has been committed to this program to aid in the clean up of orphan sites, and \$50 million to the development of improved technologies.

C.2.6.2 PROVINCIAL

Through the *Environmental Protection Act*, the Ontario Ministry of the Environment controls routine waste discharge and disposal onto land, in air and water. This eliminates routine chemical discharges that have, in the past, caused much of the known soil contamination in the Region.

The Waste Management Branch of the MOE have prepared guidelines for the decommissioning and cleanup of sites in Ontario.¹¹⁰

The Ontario Ministry of Transportation has just completed a storage tank registration program.¹¹⁰ Private owners of storage tanks were required to obtain a license by January 1, 1991. The present standards for storage tanks have been in place since May 1973. All tanks installed before that date had to be replaced before a license could be issued. This legislation does not cover fuel tanks used for home heating.

To deal with accidental contamination, the Ontario government passed legislation in 1985 requiring all spills to be reported. Spills are defined as abnormal releases of pollutants into the natural environment originating from a structure, vehicle or other container.¹¹¹ The province maintains a Spills

Action Centre to which all spills are reported on a 24-hour basis. The centre provides assistance to municipalities in dealing with a spill. Primary responsibility for the welfare and safety of the residents and the development of an emergency plan belongs to the municipalities.

C.2.6.3 REGIONAL

Municipal fire departments are the emergency service most likely to be summoned to a hazardous material incident. Due to the expense of proper emergency gear and training, which is beyond the budget of most municipal fire departments, the Regional Emergency Measures Unit has proposed acquiring a hazardous materials response vehicle, which would be available to all municipalities in such an emergency. Members of all fire departments would be trained to use this vehicle. Although not approved in 1991, the proposal will be resubmitted to Regional Council for 1992.

D WETLANDS

The value of wetlands is increasingly apparent. They purify water and thus play an important role in maintaining ground and surface water quality. Wetlands are ground-water recharge areas, allowing water to seep slowly into underlying aquifers. As discharge areas for surface ground-water, they allow stored ground-water to sustain base flow in streams during the dry season. Wetlands provide protection against flooding by holding rainfall during peak periods and releasing it over the following months. This control of spring run-off reduces water contamination from land sources and prevents reduced water supply in the summer. Wetlands also provide fish and wildlife habitat and are a natural buffer, protecting shorelines from erosion. The ability of wetlands to improve water quality is well known. The building of artificial wetlands for waste water treatment is a growing industry.

As the population increases in the rural areas of the Region, demand for ground-water supplies will increase. It is not economically feasible to provide municipal water to all rural residents and therefore it is important to protect our ground-water.

Little research has focused on the function of wetlands as ground-water recharge source and therefore wetland evaluation does not reflect the importance of the ground-water - wetland relationship. The Ontario Ministry of Natural Resources Wetland evaluation system is weak in terms of ground-water hydrology and efforts are being made to correct this deficiency. Until more is known about these functions, care should be taken to limit stress on any existing wetlands as potential damage to ground-water quality is not known.

D.1 WETLAND LOSS IN RMOC

Historically, settlements developed in rich agricultural areas near natural harbours such as in southern and eastern Ontario. These areas once contained large wetlands. Today, through urbanization, recreational and agricultural use, significant loss of wetlands has occurred. In a 1979 survey of the 31 conservation authorities, 25 reported significant wetland losses in their regions.¹¹² The extent of this loss is difficult to determine, as quantitative data bases of present or past wetland areas does not exist. All municipalities in Ottawa-Carleton have sustained significant loss of wetland. Those with the most significant wetland losses are Cumberland, Gloucester, Osgoode and Goulbourn (Table XXVI).¹¹²

The first settlement in Ottawa-Carleton centred at the junction of the Ottawa and Rideau Rivers. The first large scale drainage of the area occurred during the building of the Rideau Canal (1826 - 1832). The extent of the original wetland is unknown but the land through which the canal was built was quite swampy. Within the Greenbelt, most of the natural wetland has been drained and the shoreline has been developed. The remaining wetlands within the urban centres are extremely rare and exist only because they are protected. Those in the greenbelt and surrounding the three urban areas are under increasing pressure from urban expansion. Urban expansion can threaten wetlands directly by development or indirectly by changing the ground-water regime. The dominant characteristic of wetlands is their high water table. Large-scale paving and occupation of land in cities encourages run-off into storm sewers, decreasing recharge of the water table. Ground-water loss also occurs when ground-water drains into the sewer system. When the storm sewer system was built in the Region, significant drainage of wetland areas in the greenbelt occurred.

Table XXVI Wetland Areas in RMOC

Municipality	% Area of Wetland	% Area Originally a Wetland
West Carleton	1-5	10-20
Goulbourn	5-10	20-50
Kanata	5-10	5-10
Nepean	5-10	20-50
Rideau	10-20	> 50
Osgoode	5-10	20-50
Gloucester	1-5	20-50
Cumberland	1-5	> 50
Ottawa	<1	<5

Conservation authorities do not cite recreational development as a major factor of wetland loss. However, private dredging and filling of shoreline along rivers within the Region has reduced the natural shoreline.¹¹²

The greatest loss of wetland in recent years has been through drainage of agricultural land. Removal of water increases the fertility of the farmland, extends the growing season and increases the soil's bearing strength so that larger equipment can be used. Surface water is removed by municipal owned and maintained ditches to encourage run-off and eliminate ponding.

In the fields, buried tile drains installed in the soil remove subsurface water. Tile drainage is now a standard feature of most productive farmland. The highest percentage of tile drainage has occurred in Cumberland, Osgoode, and Goulbourn, with most drainage occurring in the 1960s and 1970s (Table XXVII).¹¹² During this time many small farms were amalgamated to create larger more efficient businesses. Farmers were encouraged to increase the productivity of their farms. As better corn hybrids became available, many switched from grain to corn for their dairy cattle to increase milk production. However, corn requires a longer growing season, more fertile soil and more intense tillage. All these factors made tile drainage affordable and necessary, and put wetlands at greater risk.

A 1991 case study of the Jock River Basin has linked wetland loss with changing land use practices that have lead to increased deterioration of river water quality.¹¹³

Table XXVII Drainage of Wetlands in RMO

Municipality	Present Value of Municipal Drainage Expenses 1949-1979	% Municipal Drainage Expenses 1959-1979	Present Value of Tile Drainage 1959-1979
West Carleton	101-500/km ²	90-100	1001-2500/km ²
Goulbourn	1001-2000	90-100	1001-2500
Kanata	1-100	50-60	1-500
Nepean	101-500	90-100	1001-2500
Rideau	501-1000	90-100	1001-2500
Orgoode	1001-2000	90-100	2501-5000
Gloucester	101-500	60-70	1-500
Cumberland	1001-200	60-70	2501-5000
Ottawa	0	0	

D.2 INITIATIVES FOR IMPROVEMENT

D.2.1 FEDERAL

The Federal Government will adopt the Federal Policy of Wetland Conservation in 1991.²³ This policy includes a system of secure wetlands of national importance, protection of wetlands on federal lands, and make wetland conservation a fundamental goal of all federal land use decisions.

D.2.2 PROVINCIAL

1) WETLAND POLICY: To provide some protection for the remaining wetlands, the Ontario government introduced "Guidelines for Wetland Management in Ontario" in 1984. This will be replaced by a policy statement¹⁴ prepared under the Planning Act in the near future. This policy statement applies to provincially significant wetlands but may be applied to areas of regional or local significance. In this policy, all Class I, II and III wetlands are identified and protected in municipal and regional official plans. Other classes of wetlands may also be protected.

Wetland classifications are determined by an evaluation that ranks wetlands according to four categories - biological, hydrogeological, social and special features. The biological category examines the diversity of plant and animal life in the wetland. Hydrogeological evaluations relate to the wetland's place in the watershed and its effects on surface water and flood control. The social components of each wetland include recreation, natural resources, and educational potential. Special features include any rare or unique characteristics of the wetland that should be conserved. The class rating allotted to each wetland depends on the total score of the evaluation. Class I and II are considered provincially significant, Class III is regionally significant and Classes IV to VII or unclassified wetlands are considered to be locally significant.

Thirty seven wetlands in the Region had been classified as of December 1, 1990 (Figure 36, Table XXVIII). Of these, 57% are provincially significant, 19% are regionally significant and 24% are locally significant. Other wetlands remain to be classified but priority is given to wetland of suspected provincial or regional significance, or locally significant wetlands under threat of development.

Figure 36 Map of Classified Wetlands in RMOC as of December 1, 1990.

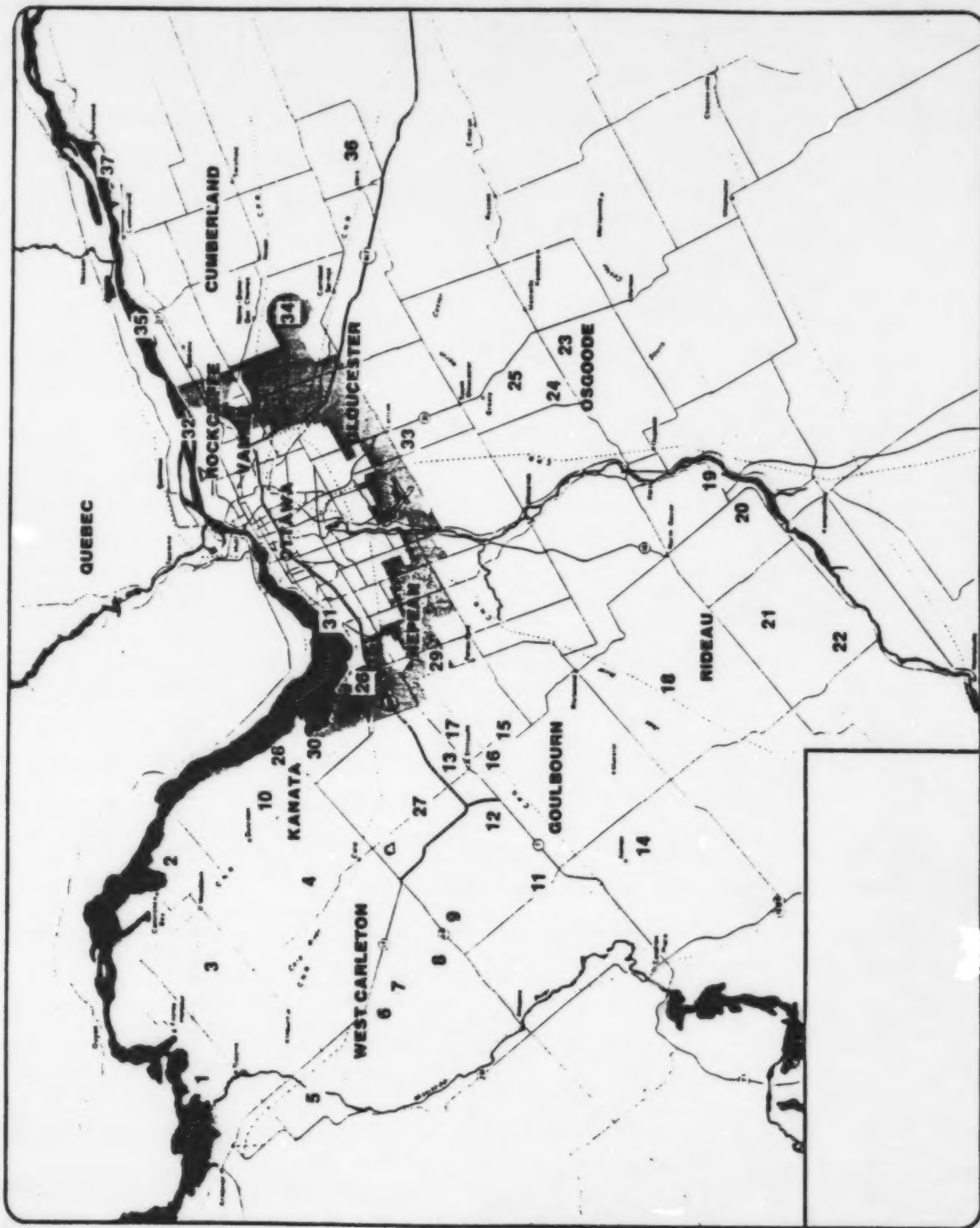


Table XXVIII Classified Wetlands in RMOC as of December 1, 1990

No.	Wetland	Classification		Municipality
		ANSI	Wetland*	
1	Morris Island Wetland		II	West Carleton
2	Constance Bay Wetland		VI	West Carleton
3	Kilmaurs Marsh	Local	II	West Carleton
4	Carp Hills Complex	Regional	I	West Carleton
5	Lower Mississippi Wetland	Regional	I	West Carleton
6	Panmure Wetland		V	West Carleton
7	Highway 17 Complex		II	West Carleton
8	Corkery Creek Wetland	Local	III	West Carleton
9	Scott Wetland Complex		IV	West Carleton
10	Constance Creek Wetland	Regional	I	West Carleton/ Kanata
11	Manion Corners Long Swamp	Provincial	I	West Carleton/ Goulbourn
12	Huntley Complex	Regional	I	West Carleton/ Goulbourn
13	Goulbourn West Carleton Wetland		VII	West Carleton/ Goulbourn
14	Prospect Bog	Local	IV	Goulbourn
15	Fernbank Wetland		III	Goulbourn
16	Upper Poole Creek		III	Goulbourn
17	Lower Poole Wetland		VII	Goulbourn

a. 1,2 - Provincially Significant; 3 - Regionally Significant; 4-7 - Locally Significant

Table XXVIII continued. Classified Wetlands in RMOC as of December 1, 1990

No.	Wetland	Classification		Municipality
		ANSI	Wetland ^a	
18	Richmond Fen	Provincial	I	Rideau/ Goulbourn
19	Cranberry Creek Part 1	Yes	III	Rideau
20	Cranberry Creek Part 2	Yes	II	Rideau
21	Steven Creek Wetland	Yes	I	Rideau
22	Brassil's Creek Wetland	Yes	III	Rideau
23	Osgoode Swamp	Yes	I	Osgoode
24	South Highway 25 Wetland	Yes	VII	Osgoode
25	North Osgoode Swamp	Yes	II	Osgoode
26	Still Water Creek Wetland		IV	Nepean
27	South March Highlands	Regional	I	Kanata
28	Mud Pond		I	Kanata
29	Stoney Swamp	Provincial	I	Nepean/ Kanata
30	Shirley's Bay/ Constance Lake Wetland	Provincial	I	Nepean/ Kanata
31	Mud Lake	Local	III	Ottawa
32	Duck Island	Yes	IV	Gloucester
33	Leitrim Wetland	Yes	I	Gloucester
34	Mer Bleu Bog	Provincial	I	Gloucester/ Cumberland
35	Petrie Island	Yes	II	Cumberland
36	Limoges Wetland Complex	Yes	I	Cumberland
37	Basie Lafontaine	Yes	III	Cumberland

Yes indicates that the wetland has been designated ANSI status but the classification has not been confirmed.

a. 1,2 - Provincially Significant; 3 - Regionally Significant; 4-7 - Locally Significant

2) **AREAS OF NATURAL AND SCIENTIFIC INTEREST (ANSI):** These are publicly or privately owned land or water areas with earth or life science features that have important natural heritage, scientific or educational values.¹¹⁵ ANSI were approved as a Provincial policy in January 1983. A program to evaluate natural areas for ANSI status by MNR was funded in 1987. There are presently 564 designated ANSI in Ontario; 76 of these are located in the Region.¹¹⁶

ANSI sites are selected using geological or biological studies. A rating system determines if the chosen areas are of provincial, regional or biological significance. Once selected, ANSI sites can be protected by a variety of programs including; registry, landowner contract, stewardship awards, tax rebates, conservation easements or acquisition. Areas of provincial significance may be regulated under the *Provincial Parks Act*. Wetland ANSIs are listed in Table XXVIII.

3) **CONSERVATION LAND TAX REDUCTION PROGRAM:** This program is unofficially called "Untaxing Nature" and is unique in Canada.¹¹⁷ It is the result of cooperation between the Ontario Ministries of Natural Resources, Revenue and Municipal Affairs. Beginning January 1, 1987, landowners who agreed to maintain identified conservation lands in their natural state had their property taxes paid by the Ontario Government. Class I, II and III wetlands and provincially significant areas of natural and scientific interest, conservation authority lands that do not produce revenue and conservation lands owned by non-profit groups qualify for the Ontario Conservation Land Tax Reduction program. Some 250 000 hectares in Ontario are eligible for this rebate.

D.2.3 MUNICIPAL

Goulbourn Township's draft wetlands policy will require protection of all Class IV wetlands within the municipality. No other municipality in the Region has a wetlands policy. The RMOC plans to examine this issue for its new official plan.¹¹⁸

E PESTICIDES

All pesticides are poisons designed to control or kill specific pests. Hence, at some dose level, most will affect humans too. Some pesticides are more poisonous than others and a small dose will produce harmful effects. Other pesticides are less toxic and a larger dose is necessary to cause an effect. This toxicity varies with chemical structure, route of absorption into the body and body weight of the host. The most common routes of exposure are by ingestion, through the skin and by inhalation. Human susceptibility to pesticide exposure depends on age, sex and general state of health. In general, the very old and very young are most susceptible, as their metabolism is less efficient.

Pesticides, like other domestic chemicals, provide a useful function when used properly. Danger to health occurs through improper handling and misuse. Humans are exposed to pesticides through unsafe storage, improper application, contact with chemical residues after application, through contamination of drinking water and in food.

Pesticides should be stored in their original container, with the label intact. The pesticide label is very important as it contains all the information necessary for safe use. The content of this label is controlled by federal law. Chemicals should be locked in a dry place, away from children and animals. Ideally, home owners should not keep surplus pesticide, but should buy only enough for the intended use. Any spilled chemicals should be cleaned up immediately.

It is important to wear protective clothing when applying pesticides to avoid contamination. Pesticide mixtures should be prepared as directed and equipment carefully cleaned after use. Many spills resulting in environmental contamination occur as a result of improper or careless handling. The risk of passive exposure to pesticide residues after application depends on the chemical used and the method of application.

Pest control methods are now available that minimize or even eliminate chemical use for both building and land applications (See Section III.E.3.3.2). Responsible pest control professionals will use techniques that limit chemical exposure. However, many of these new methods of pest management will not be implemented unless the consumer demands them.

Symptoms of pesticide exposure vary with the type of chemical. Inhalation of pesticides can cause irritation of the nose and throat, coughing, chest discomfort, listlessness or breathing difficulty. Eye and skin irritation may occur. Chronic skin contact can cause dermatitis. Swallowing large quantities of a pesticide will cause nausea, vomiting, diarrhoea, headaches and/or unconsciousness.

The pesticides available on the market today are not considered carcinogenic. Specific concern since the 1960s about the safety of 2,4-D in particular has led to several large scale studies throughout the world. The results of these studies have not been consistent in part due to study methods used. One factor is that some former 2,4-D containing products also included other phenoxy herbicides which may be carcinogenic. However, considering all the evidence and using the criteria of the International Agency for Research Against Cancer, there is still inadequate evidence that 2,4-D by itself is carcinogenic.¹¹⁹

E.1 PESTICIDE USE

E.1.1 LAND APPLICATION

Pesticides are used mainly to:

- 1) control insects in buildings - applied by pest control companies
- 2) control weeds and insects in lawns - applied by landscaping and lawn care companies
- 3) control insects and weeds in and around private property - applied by individuals
- 4) control insects and weeds in agricultural lands - applied by farmers and their contractors

Data on the type and quantity of pesticides used in the commercial sector is not available. The most visible form of pest control is by lawn care companies. The most common pesticides used by these companies are MCPA, MCPP, and dursban; 2,4-D was the herbicide of choice but is being phased out due to the public's concern about its toxicity by the public. The toxicity of these products is given in Table XXIX.

An Ontario-wide survey to identify and quantify the pesticides used in the province by the Ontario Ministry of Agriculture and Food (OMAF) has been carried out every five years since 1973.^{120,121} In 1988, Ontario agriculture used 6.2 million kilograms of pesticide. Seventy percent of this amount was herbicides, with the remaining 30% including fungicides, insecticides, nematocides and growth regulators. Southern Ontario used the most: 64% of all pesticides and 56% of all herbicides. In contrast, Eastern Ontario used 8% of total herbicides and Ottawa-Carleton accounted for 0.3% (14 570 kg). Herbicides applied on corn, grains (including wheat, barley and oats), and hay/pasture accounted for over 90% of agricultural pesticide use in the RMOC.

The survey lists the three main classes of herbicides used in agriculture: triazines, phenoxy herbicides and other herbicides. The most common pesticides in each class used in Ontario during 1988 are listed in Table XXX. This data is not available for RMOC alone.

To compare agricultural herbicide use in RMOC with other municipalities in Ontario, 10 counties representative of herbicide use in Ontario are given in Table XXXI. The use of all three types of herbicides in Ottawa-Carleton is very low compared to western and southern Ontario. In most counties there was a decrease in herbicide use between 1983 and 1988. This is the first decrease in pesticide use since the survey began in 1973 and may have been partly due to drought conditions experienced in 1988 in many parts of the province. The use of long-lasting triazine pesticides has also decreased, perhaps because farmers prefer the flexibility that a low-residue pesticide gives them to switch crops in response to market conditions.

A 1991 Statistics Canada report compares the quality of the Jock River Basin between 1971 and 1986.¹¹³ The total cost of pesticide applied in this basin (in 1971 dollars) increased from \$33 330 in 1971 to \$75 526 in 1986. The total basin tonnage of fertilizer also increased from 1615 tonnes in 1971 to 3295 tonnes in 1986. This increase in pesticide use can be attributed partially to cultivation of corn, which increased over 2.5-fold between 1971 and 1986.

Table XXIX Toxicity of Commonly Used Pesticides

PESTICIDE	TOXICITY: LD ₅₀ (mg/kg) ^a		CHEMICAL FAMILY ^a	PERSISTENCE IN ENVIRONMENT ^a
	INGESTED	SKIN		
Atrazine (H)	1750	7500 R	triazine	cannot rotate crops for 1-2 years after application
Bromoxynil (H)	190	> 3660 ³ R	nitrile	essentially no soil residual activity
Butylate (H)	4000	> 2000 ³ R	carbamate	One season
Cyazafop (H)	149	1200	triazine	One season
2,4-D (H)	370	1500	Phenoxy	1-2 weeks half-life
2,4-DB (H)	700	800	Phenoxy	essentially none
Dicamba (H)	1040	> 1000	benzoic acid (phenoxy)	approx 30 day half-life
Durban (I)	135-163	202	organophosphate	
Diflufenquat (H)	270	3540	quaternary ammonium ³	essentially none
EPTC (H)	1630	1460 R	carbamate	One season
Glyphosate (H)	1568	> 7940 R	organophosphate	None
MCPA (H)	700	> 1000 ³	phenoxy	1-2 months
MCPB (H)	680	1000	phenoxy	susceptible plants convert to MCPA
MCPP (H)	930 ³	900 ³ R	Phenoxy	1-4 weeks
Metolachlor (H)	2780	> 3170 ³	acetanilide	10-12 weeks

(H) Herbicide; (I) Insecticide; All LD₅₀ tests on rats unless indicated by R

Table XXIX continued. Toxicity of Commonly Used Pesticides

a. The accepted method of recording the relative toxicity of a pesticide is the Lethal Dose 50% (LD_{50}) value. This is the statistical estimate of a chemical dose which, when administered, will kill 50% of the test animals under stated conditions. The LD_{50} values are expressed as milligrams of dose per kilogram body weight of the test animal. The LD_{50} values for the test animal are recognized to differ from the response of humans, but are useful in classifying pesticide chemicals according to their relative toxicity. The larger the LD_{50} value, the lower the relative toxicity. Unless otherwise indicated, LD_{50} values are from reference 1.

b. The toxicity and mode of action of a pesticide is generally the same for all chemicals of one class. TRIAZINES: Herbicides of mild toxicity to humans, which disrupt photosynthesis, a process specific to plants. They are very persistent in soil. CARBAMATES: Herbicides and fungicides of this class are mildly toxic to humans; the insecticides are more toxic. They are less persistent in the environment. PHENOXY: Low to moderate toxicity to humans. Low persistence in the environment. ORGANOPHOSPHATE: Insecticides that act as cholinesterase depressants. They are toxic to humans and must be applied with care. However, they have low persistence in the environment, therefore decreasing in toxicity to humans shortly after application. Reference 2 unless otherwise indicated.

c. Persistence in the environment is the length of time that the pesticide will remain active in the environment. The more persistent the chemical is, the greater is the potential for contamination by runoff, uptake through the food chain and exposure through direct contact. The half-life is the time required for the concentration of an application to decrease by half. Few pesticides that persist for more than one season are now in use. By contrast, organochlorines such as DDT have half-lives of many years and have the potential to bioaccumulate to toxic concentrations in animals and humans.

REFERENCES:

1. 1980 Registry of Toxic Effects of Chemical Substances, Volume 1 & 2. NIOSH publication No. 81-116.
2. Pesticide Safety Handbook, Ontario Ministry of the Environment, 1986.
3. 1990 Guide to Weed Control, Ontario Ministry of Agriculture and Food.

Table XXX Most Common Pesticides Used in Ontario Agriculture, 1988

PESTICIDE	AGRICULTURAL CROP ^{a,b}		
	CORN	GRAINS	HAY/PASTURE
Triazines:			
Atrazine	81.6%	96.3%	100%
Cyanazine	18.2 %	—	—
Misc	0.2%	3.7%	—
Total	1 224 030 kg	6750 kg	2540 kg
Phenoxy Herbicides:			
2,4-D	19.2%	28.1%	18.0%
2,4-DB	—	12.9%	37.7%
MCPA	—	50.3%	30.8%
MCPB	—	—	11.7%
Dicamba	76.4%	—	—
Misc	4.4%	8.7%	1.8%
Total	162 430 kg	409 580 kg	16 140 kg
Other Herbicides:			
EPTC	20.9%	—	—
Glyphosate	—	81.2%	95.9%
Butylate	9.6%	—	—
Metolachlor	64.5%	—	—
Bromoxyl	—	9.4%	—
Difenzoquat	—	7.3%	—
Misc	5.0%	2.1%	4.1%
Total	1 104 910 kg	74 981 kg	25 810 kg

a. Corn, grain and hay/pasture are the primary agricultural crops in RMOC

b. % per cultivated hectare

Table XXXI Ontario Survey of Pesticide Use

COUNTY	LOCATION	TRIAZINE HERBICIDES		PHENOXY HERBICIDES		OTHER HERBICIDES	
		1983	1988	1983	1988	1983	1988
Stormont, Dundas & Glengarry	Eastern Ontario	0.499	0.902	0.102	0.331	0.426	0.372
Ottawa-Carleton	Eastern Ontario	0.462	0.046	0.066	0.048	0.217	0.105
Frontenac	Eastern Ontario	0.104	0.018	0.211	0	0.147	0
Hastings	Central Ontario	0.319	0.134	0.108	0.051	0.357	0.039
Victoria	Central Ontario	0.378	0.191	0.072	0.072	0.534	0.301
Simco	Western Ontario	0.368	0.610	0.088	0.046	0.644	0.037
Huron	Western Ontario	1.025	0.219	0.146	0.065	1.227	0.399
Oxford	Southern Ontario	0.920	0.206	0.220	0.071	1.005	0.064
Essex	Southern Ontario	0.420	0.506	0.034	0.081	1.433	1.867

All quantities are kilogram per cultivated hectare

E.1.2 PESTICIDE CONTAMINATION OF WATER

The potential presence of pesticides in drinking water supplies is a major health concern today. In the 1960s and 1970s, the most commonly used pesticides were chlorinated hydrocarbons. These effective insecticides and herbicides were stable in the sunlight, allowing an application to be effective longer. By the 1980s, it was apparent that this stability led to bioaccumulation through the food chain in fish, birds, animals and humans. Some, like DDT and PCBs, were found to have half-lives of many years.

Use of these pesticides is either not allowed or severely restricted. However some residues are still found in routine monitoring. The Ontario Drinking Water Surveillance Program routinely monitors pesticides. Hexachlorobenzene was detected in the Ottawa River in 1986 and 1989 in minimal quantities in raw water, but not treated water. (These chemicals tend to bind to particulate suspended in the raw river water, which is removed during the treatment process.)

Chlorinated pesticides are also monitored by the Ontario Ministry of Natural Resources in sport fish.³⁰ As fish filter large quantities of water through their gills, they are a good indicator of the chemical contamination of a water supply. PCBs, mirex, DDT, toxaphene, HCB, lindane, heptachlor, aldrin and chlordane are all chlorinated pesticides that have been found in Ontario fish. The levels of these chemicals in fish have declined in the last two decades. Although pesticide residues can still be found in some fish, they are well below the levels of concern for human health.

Pesticides currently in use are listed in Table XXIX. This new generation of pesticides is less persistent in the environment than the chlorinated pesticides listed above. With the exception of the triazines, few pesticides remain in the soil for more than one season. This low persistence in the environment reduces health concerns for humans due to bioaccumulation.

Although the health concerns due to contamination of water by these pesticides are minimal, residues can be found in drainage basins where large quantities of pesticides are routinely applied. More than half of pesticide movement into surface waters comes from storm run-off, 16-25% from tile drainage and 18-25% from human error.³¹ Some run-off and tile drainage of pesticides is due to soil erosion.

Southern Ontario applies the most pesticide per hectare¹²¹ and has the highest percent of tile drainage of any area in Ontario.¹²² Consequently, it is most likely to have pesticide-contaminated surface waters. Between 1981 and 1985 the three major agricultural rivers in Southern Ontario were sampled and analyzed for 48 of the 85 pesticides in current use.¹²³ Thirteen herbicides and three insecticides were identified. Atrazine was the only pesticide found year round in all basins. The remaining pesticides were found only during the spraying season. Pesticide concentrations were heaviest when heavy rains followed immediately after pesticide applications.

No similar studies of pesticide run-off have been conducted in the RMOC. However, application of pesticides in the Region is almost 200-fold less than in southern Ontario.¹²¹ Therefore any contamination would probably be too low to detect by current methods.

Direct ground-water contamination is primarily due to human error at or around the farm well. This is a chargeable offence under the *Pesticides Act*, the *Water Resources Act* and the *Environmental Protection Act*. Pesticides have been detected in some wells in Southern Ontario. However, the MOE

has never charged anyone in RMOC for such an offence.¹²³ This type of contamination is being addressed through education programs (See Section III.E.3.2.2).

Another concern is the use of pesticide on lawns. As with agriculture, the main source of water contamination is human error or soil erosion. Water contamination due to run-off is negligible if the lawn is healthy.¹²⁴ As with agriculture, direct contamination through human error is an offence and can best be eliminated through education. Organic alternatives to lawn pesticides are now readily available in the Region.

E.1.3 PESTICIDE RESIDUES IN FOOD

In the 1988 Ontario Ministry of Agriculture and Food Survey of Pesticide Use in Ontario,¹²¹ 13.8% of the pesticide use was on fruit and vegetable crops, and 0.54% of this was applied to crops in RMOC. Most of the fruit and vegetables consumed in the Region are either grown in Southern Ontario or imported. Thus, although the use of pesticides on commercial food crops in the Region is minimal, residents of the Region are affected by pesticide residues on fruit and vegetables imported from other parts of Ontario and from other countries. Several programs exist to monitor pesticide residues in food.

The national Food and Drug Act specifies allowable pesticide residues in foods. Three authorities - Health & Welfare Canada, Agriculture Canada and OMAF monitor pesticide residues in fruit and vegetables. Programs in action between 1986-1989 are listed in Table XXXII.¹²²

Health and Welfare operates the National Surveillance Program; Agriculture Canada applies the *Canadian Agricultural Products Act* to enforce federal pesticide residue tolerances. Both AgCan and HWC establish priority lists of domestic and imported goods to be sampled for pesticides. One of the main objectives of the Ontario program is ensuring that there are no pesticide residues in food grown using an OMAF pesticide application regime.

Table XXXII Pesticide Monitoring Programs for Fruit and Vegetables

FOOD	% COMPLIANCE	NUMBER OF VIOLATIONS
1. Health & Welfare Canada: 1986-1989		
Domestic	99.7 %	pears (1)
Imported	96.0 %	apples (3), nectarines (6), peaches (4), melons (1), bananas (1), grapes (15)
2. Agriculture Canada: 1987-1989		
Domestic	99.8 %	corn (1)
Imported	99.3 %	grapes (1), oranges (6), peaches (1)
3. Ontario Ministry of Agriculture & Food: 1986-1988		
Fruit	96.4 %	grapes (1), peaches (1), pears (2), raspberries (4), strawberries (3)
Vegetables	99.3 %	celery (2), peppers (1)

E.2 INCIDENCE OF EXPOSURE TO PESTICIDES

Table XXXIII Calls to Poison Information Centre, Children's Hospital of Eastern Ontario

PESTICIDES		INFORMATION REQUESTS	EXPOSURES				
			< 5 yrs	5-18 yrs	Adults	Animals	Total
Insecticides	1988	227	121	8	91	19	239
	1989	223	69	25	76	28	198
	1990	184	104	21	112	42	279
Herbicides	1988	34	13	8	11	0	32
	1989	24	16	3	13	5	37
	1990	21	11	5	18	12	46
Rodenticides	1988	14	25	4	10	7	46
	1989	15	22	0	10	12	44
	1990	14	44	1	16	32	93
Animal repellants	1988	2	2	1	0	2	5
	1989	0	1	1	0	0	2
	1990	4	2	1	2	0	5
Insect repellants	1988	9	21	8	3	0	32
	1989	9	49	9	0	3	61
	1990	16	45	14	9	3	71

Pesticides are the source of 3.5% of calls received by the Poison Information Centre of Eastern Ontario. Details on pesticide calls are given in Table XXXIII¹²⁶; requests include questions about safety, toxicity and use of the pesticide, particularly insecticides used for spraying of homes. Those classified as "exposures" include accidental pesticide contact. The rate of pesticide exposure is probably much higher than stated due to underreporting. Animals and children 0-5 years are usually exposed accidentally during or immediately after a pesticide application, or because of improper storage of pesticides. Most adult exposures are due to applying pesticides without taking safe precautions. Children aged 5 to 18 are least likely to suffer accidental exposure to pesticides.

E.3 INITIATIVES FOR IMPROVEMENT

E.3.1 FEDERAL

The federal *Pesticides Control Products Act* was implemented in 1972 and revised in 1982, and requires any pesticide offered for sale or use in Canada to be registered. Before registration, the manufacturer must prove that the product is safe and effective when used as directed on the label. Therefore the public can assume that as long as the product is used correctly, the application of pesticide will not result in a health hazard.

E.3.2 PROVINCIAL

E.3.2.1 ONTARIO MINISTRY OF THE ENVIRONMENT

The *Pesticides Act* monitors the correct use of pesticides. It regulates the storage, display, sale, use, transportation and disposal of pesticides. This is accomplished by classifying the product and licensing the businesses and individuals that sell and apply pesticides.

All pesticides registered under the federal Act must also be registered under the provincial Act before they can be sold in Ontario. The products are listed in one of six schedules according to their toxicity, environmental/health impact and use. Access to some pesticides is restricted to persons who need them and know how to handle them properly.

Pesticides for residential use are obtained from, or applied by the commercial sector. Under the Pesticide Act there are three types of commercial licenses. A vendor's licence is required to sell chemicals at wholesale or retail levels; an operator's licence is issued to an individual who buys chemicals for the purpose of operating an extermination business; and a separate exterminator's licence is issued for application of pesticides on land, water or in buildings.

Within these three categories, licences and specific training are required. The more toxic the pesticide, the higher the level of licence required to use it. At this time one licensed exterminator can supervise up to three unlicensed personnel.

In RMOC, MOE has issued 143 operator's licences; 127 of these are for land pest control companies and 16 are for structural pest control businesses. Another 373 individuals hold land exterminator's licences and 51 hold structural exterminator's licences.

Under the June 1990 amendments to the *Pesticide Act*, public notification (in the form of signs) must be given when pesticides are used on public or private land. This helps meet the public's increasing demand for information on where/when pesticides will be used and allows people to take precautions to avoid exposure. Studies show that small amounts of pesticides can be dislodged for up to 48 hours after spraying. After this time period, exposure to pesticide is rare.¹²⁷

It is now required to post notice of intent 24 hours before spraying public and commercial property. These signs must be kept in place for 48 hours after spraying and must be placed at 100 m intervals with the sign highly visible and at the entrance to public properties. On residential property,

signs must be posted 48 hours after spraying every 100 m along the frontage and perimeter of the land or at access points if the land is fenced off. Farmland does not have to be posted unless the spraying is done by a licensed pest control applicator. Failure to post signs could result in fines up to \$10 000 per day for individuals, or up to \$50 000 per day for corporations.

E.3.2.2 ONTARIO MINISTRY OF AGRICULTURE AND FOOD

Widespread use of agricultural pesticides causes concern about food and water contamination, pest resistance, changing pest dominance and lack of pesticide alternatives. Under the *Ontario Pesticide Act*, farmers are not required to hold a license for the use of schedule 2, 3 and 5 pesticides if they are being used on field crops or within farm buildings. Farmers are major users of herbicides and insecticides and it is recognized that some control over product use is needed. These have been addressed by the Ontario Ministry of Agriculture and Foods (OMAF) by "Food Systems 2002." By the year 2002 this comprehensive program is designed to decrease the use of pesticides in agriculture by 50%. This 15-year research, education and field delivery program aims to meet this goal without decreasing crop yields or compromising pest control.

1) **RESEARCH:** The goal is to develop and implement non-chemical alternatives such as the breeding of pest-resistant plants, biological control, crop rotation and cultural practices, and improved efficiency of chemical applications, allowing lower concentrations. Timing of spraying, methods of spraying, band applications and inter-row cultivation will all be considered.

2) **EDUCATION:** A *Grower Safety Course* prepared by MOE and OMAF in conjunction with Ridgetown College of Agricultural Technology has been available since 1987. To date over 300 farmers in the Region have taken this course. Since April 1, 1991, farmers must show a certificate from this course for the purchase of schedule 2, 3 and 5 pesticides.

3) **FIELD DELIVERY:** Pest management specialists will assist farmers in reducing pesticide use by implementing new techniques.

It is estimated that cutting pesticide use will save farmers more than \$100 million in chemical costs by 2002 and reduce the potential for operator exposure and pesticide contamination of food and water.

E.3.3 REGIONAL

E.3.3.1 LAND APPLICATION

In November 1990, all municipalities in the Region and several other public agencies were surveyed by telephone about their pest-control policies. The general trend was reduced reliance on pesticides and awareness of their residents' concerns about pesticide use. Most municipalities are in the process of modifying their pesticide use. The application of herbicides, once a routine several times per year, is now restricted to once a year, once in several years, or only as needed.

The term "only as needed" usually refers to spraying areas where the weeds are out of control or where noxious weeds are present. Under the *Ontario Weed Control Act*, 23 weeds including poison ivy, milkweed, ragweed and thistle are classified as noxious.

Other modifications include switching the pesticide application from liquid spraying to granular form to reduce chemical exposure, or experimenting with alternate forms of lawn maintenance such as organic turf management systems.

1. NATIONAL CAPITAL COMMISSION: The NCC manages approximately 2500 ha of grassy area.¹²⁸ It recognizes the public's concern about long-term health effects due to pesticide application and is investigating ways to decrease the use of pesticides on NCC property. Programs implemented in 1990 include application of pesticides or fertilizers to Parliament Hill, deleting spring 1990 application of pesticides for broadleaf control, testing of low maintenance grass seed, formulation of an organic turf management program and conversion of 60 ha of groomed turf to naturalized or meadow grass areas.¹²⁹

2. TOWNSHIP OF CUMBERLAND: This Township has no written policy but is now in the process of developing standards. Cumberland has a three-year park maintenance cycle, applying natural fertilizers as much as possible. Herbicides are sprayed only as needed. Routine roadside pesticide applications are made.

3. CITY OF GLOUCESTER: The City of Gloucester maintained its parks until 1989 with routine spraying of pesticides every three years. Undeveloped land or passive parkland is only sprayed for noxious weeds. In the spring of 1990, a moratorium was put on pesticide spraying within the township. A special committee, formed to investigate pesticide use, lifted the moratorium for the remainder of the year. At the current time, the moratorium is in effect for 1991 but is expected to be lifted again.

4. TOWNSHIP OF GOULBOURN: Goulbourn tries to do as much maintenance as possible to avoid using pesticides. When needed, spraying was contracted to a commercial firm but will be taken over by the township next summer. Herbicide with a 2,4-D base is sprayed once a year in high-profile parks.

5. CITY OF KANATA: The City of Kanata have decreased herbicide application to once a year on its parks, primarily sports fields, and is considering a total ban. The granular form of 2,4-D herbicide mixed with fertilizer is used to minimize herbicide exposure to people and their pets. Insecticide spraying is done only when necessary and is contracted to a commercial company. Kanata has also contracted five

parks to an organic lawn maintenance company as a pilot project. The community is encouraged to get involved in their parks and to participate with the contractor to pick weeds.

6. CITY OF NEPEAN: Nepean residents have expressed concerns about pesticide use in their parks. However the City of Nepean feels controlled spraying is sometimes necessary. The city's policy is to keep its parks 80% weed free using 2,4-D in "Weed & Feed" granular formulation when necessary. Parks and school yards are treated in the summer when children are less likely to be exposed to the pesticide.

7. TOWNSHIP OF OSGOODE: Osgoode does not spray road sides or parks. Grass and weeds are controlled by mowing.

8. CITY OF OTTAWA: The City of Ottawa has not used herbicides since 1978. Insecticides were used to maintain trees. In 1990 the tree spraying program replaced pesticides with insecticidal soaps. Roadsides are maintained by mowing.

In February 1990, the Environmental Advisory committee of City of Ottawa submitted a proposal to private and commercial sectors to declare the City of Ottawa a pesticide-free zone. It recommended that (i) all city departments stop using pesticides; (ii) a training program be implemented to train city employees and the public in pesticide alternatives; (iii) the public, institutions and businesses be urged to cease application of pesticides; (iv) that chemical lawn companies be encouraged to switch to organic lawn care; and (v) that all vendors be asked to stop selling pesticides. This proposal has not been implemented but a pesticide policy will be included in the new official plan.

9. TOWNSHIP OF RIDEAU: Rideau Township no longer sprays its parks except for noxious weeds such as poison ivy which must be controlled under the Ontario Weed Control Act.

10. VILLAGE OF ROCKCLIFFE PARK: Rockcliffe Park does not have an official policy. The Village Green is sprayed once a year. The subdivision agreement for private property abutting M'Kay Lake and the adjacent pond does not allow use of chemicals near the water.

11. CITY OF VANIER: Vanier has not used pesticides for the past two years. Only fertilizer is applied to its parks.

12. TOWNSHIP OF WEST CARLETON: The Township of West Carleton would like to develop a pesticide policy to apply to all parks. Currently, each park is maintained by a community association that controls pesticide application.

13. REGIONAL MUNICIPALITY OF OTTAWA-CARLETON: The Region does not have an official policy. Weeds on Regional roads are controlled by mowing. No pesticide applications are planned for 1991. The maintenance of Regional grounds is contracted to private companies that use fertilizers and pesticides at their discretion.

E.3.3.2 STRUCTURAL APPLICATION

Pesticides are most commonly used in buildings for the control of cockroaches. Regional residents, particularly in apartment buildings, are very concerned about exposure to pesticides during treatment of their homes with insecticides. They are worried about exposure to chemical fumes and residues, particularly for their children and pets. On the otherhand, cockroaches are implicated in the spread of pathogenic microorganisms¹³⁰ and in human allergies¹³¹ and therefore must be controlled. Integrated Pest Management¹³² (IPM), a method of pest control that minimizes chemical application by using non-chemical methods, addresses many of these concerns. The Ontario Ministry of the Environment is encouraging pest control companies to adopt this technique. IPM relies on a mixed approach to minimize the use of insecticides and to ensure greater long-term effectiveness. The elements of this approach are listed in Table XXXIV.

Table XXXIV Techniques Used in Integrated Pest Management

• Monitoring for the presence of insects using glue boards.
• Data collection to understand past history of a unit.
• Non-spraying methods of insecticide application i.e. bait stations, chalking and improved sanitation.
• Using formulations of insecticides that reduce exposure i.e. Microencapsulated, water based sprays.
• Spraying in only those areas where the insects live i.e. cracks and crevasses, not surface areas
• Education of tenants and staff.

As education of landlords, pest control contractors and residents continues, IPM will become more common. From a health perspective, IPM is the desired approach to pest control as it minimizes exposure of both the pest-control technician and occupants to chemical insecticides while maintaining control of insects. IPM is also being used by some pest-control companies in restaurants.

The Ottawa-Carleton Regional Housing Authority is one of the first management companies to implement IPM in Ottawa. This agency is an independent crown corporation that manages approximately 8500 units of rent-to-income housing for the Ontario Ministry of Housing. Traditionally, rental management companies rely on insecticide spraying for control of insects in their buildings. Public areas, units that are vacant, units with insect infestations, units adjacent to units with infestations, as well as those units requested by tenants or recommended by contractors were sprayed routinely. Since January 1, 1990, the Housing Authority has been practising Integrated Pest Management in its units.¹³³ This program also employs community relations workers to work with tenants if insect infestations are attributed to unsanitary conditions.

After nine months implementation, the total number of units sprayed with insecticide for

cockroach control decreased by 45% when compared to the same period in 1989 (Table XXXV). This decrease was due to monitoring before treatment to determine the level of insect activity present. Only those units displaying insect activity exceeding established threshold or tolerance levels were sprayed. The current threshold limit used by Ottawa Housing is three cockroaches per unit, monitored over a seven-day period. Units with minor activity (1-2 cockroaches per unit) and those next to units with high activity were treated with bait stations.

In addition to routine pest control, three complete buildings with chronic cockroach infestation problems were treated. A total of 725 units were monitored, with 119 receiving full treatment and 200 receiving bait stations. In the past, all units would have been sprayed with insecticide at once to eliminate travel of the insects from unit to unit. Using IPM, the reduction in insecticide spraying was 84%. In follow-up monitoring, only 10% of units had new infestations. Only 40% of these units required insecticide spraying; the others were treated with bait stations. This preliminary data suggests that with specific treatment, travel of insects is minimal. More data is necessary to verify this.

Table XXXV Comparison of Total Treatments for Cockroaches between Jan 1/89-Sept 30/89 and Jan 1/90-Sept 30/90.

Treatment	Jan 1-Sept 30, 1989 Before IPM	Jan 1-Sept 30, 1990 After IPM		
		Monitoring	Tenant Complaints	Total
Full Spray	1553	409	442	851 (-45%)
Bait Stations	355	461	40	501
Total	1908	870	482	1361
Units monitored	NA	3375	NA	NA

F NOISE

Noise is defined as any unwanted sound. It is very subjective. What is considered noise by one person may be acceptable to another. Noise pollution is excessive noise levels at a duration that interferes with quality of life. Noise pollution may cause temporary or permanent hearing loss, affect people's circulatory or nervous systems¹³⁴, disturb sleep and relaxation¹³⁵, interfere with communication, and cause general annoyance, irritation and public nuisance.¹³⁶

Noise levels are measured in decibels of sound pressure (dB). In Canada, indoor noise is considered excessive if it exceeds indoor background levels by more than approximately 5 dB. Quiet interiors range from 25-35 dB. The maximum acceptable level in a bedroom is 35 dB.¹³⁷ Outdoor levels above 55 dB are deemed excessive. Common noise levels and typical reactions are listed in Table XXXVI.¹³⁸

Table XXXVI Representative Noise Levels and Human Response

Sound Source	Noise Level (dB)	Human Response
Carrier Deck, jet operation	140	
	130	Painfully loud, limit amplified speech
Jet takeoff (200 ft)	120	Maximum vocal effect
Discotheque, auto horn (3 ft)	110	
Jet takeoff (2,000 ft)	100	
Busy city street, heavy truck (50 ft)	90	Very annoying, hearing damage (8 hour)
Pneumatic drill (50 ft), alarm clock	80	Annoying
Freight Train (50 ft), freeway traffic (50 ft)	70	Telephone use difficult
Air-conditioning unit	60	Intrusive
Light auto traffic (100 ft)	50	Quiet
Living room, bedroom	40	
Soft whisper (15 ft)	30	Very quiet
Broadcasting studio	20	
	10	Just audible
	0	Threshold of hearing

F.1 SOURCES OF NOISE

There are three main classes of environmental noise: residential, industrial/commercial and transportation. Residential noise sources include stereos, lawn mowers, air conditioners, heat pumps and swimming pool pumps. Work-related noise is produced by factories, equipment and construction activities. Transportation noise is generated by traffic including buses, trucks, cars and aircraft. The main sources of noise from motor vehicles are engine-exhaust systems and tires.

The Organization for Economic Cooperation and Development attributes increased environmental noise in populated areas to increased transportation.¹³⁹ Traffic noise takes two forms: continuous high background noise from heavy traffic on a main route, and sporadic peaks of noise over the low background levels in residential areas. As the population of Ottawa-Carleton increases, both forms of noise will increase.

Aircraft cause noise in the air and on the ground. Noise on flight paths close to airports increases to a peak as the plane flies overhead and decreases as it passes. Ground noise is emitted during engine run-up, taxiing and takeoff. Aircraft ground noise is less direct than flight noise but of longer duration.

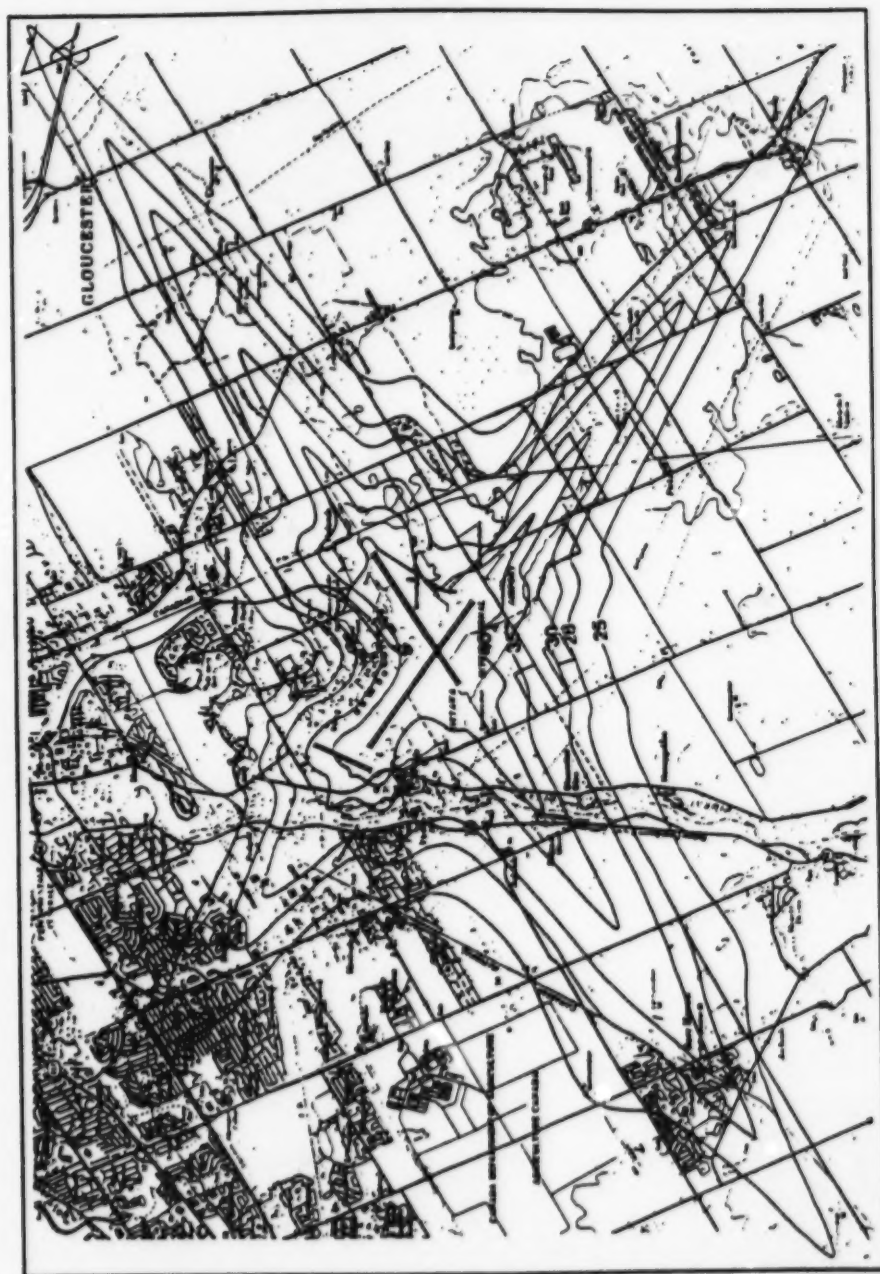
The current Transport Canada noise evaluation system is the Noise Exposure Forecast (NEF). NEF is used to map noise contour lines around an airport. NEF units increase logarithmically, so that a 10 unit increase is twice as loud. Noise less than 35 NEF will not cause mental or physical illness or permanent loss of hearing. Transport Canada bases public tolerance to noise on the number and type of complaints received (Table XXXVII).¹⁴⁰ Few complaints occur at levels less than 25 NEF.

Table XXXVII Adverse Community Reaction to Noise

RESPONSE AREA	COMMUNITY RESPONSE PREDICTION
Less than 30 NEF	Sporadic complaints may occur. Noise may interfere with certain activities of the resident.
30-35 NEF	Sporadic to repeated individual complaints. Group action is possible.
35-40 NEF	Individual complaints may be vigorous. Possible group action and appeals to authorities.
Greater than 40 NEF	Repeated individual complaints are likely. Concerted group and legal action might be expected.

The 1988 NEF contour map for the Ottawa International Airport (Figure 37) was prepared for Central Mortgage and Housing Corporation by the Ministry of Transport in 1983. Flight noise emanates from two Ottawa Airport runways that are almost perpendicular to each other. Areas northwest, southwest, southeast and northeast of the airport are directly under the flight paths. The 25 NEF contour for one runway covers a swath from Baseline and Merivale roads to Greely. Barrhaven, located

Figure 37 1988 NEF Contour Map for Ottawa International Airport



southwest of the second runway, receives noise levels of 25-30 NEF. The northeast tip of this swath has the least impact on residents as it is directly over the greenbelt.

F.2 INITIATIVES FOR IMPROVEMENT

Noise is a difficult source of pollution to control. It is best reduced at the source through development of quieter technology or by segregating noisy activities from residential areas through land use planning. Remedial control measures include disrupting the path of noise transmission by setting up sound barriers or by soundproofing the affected residential area.

A 1965 WHO committee listed the following preventive measures for noise control planning¹³⁸:

- 1) Location of land uses that generate excessive noise outside of the city limits. i.e. superhighways, airports and industry
- 2) Improvement of noise-generating technology
- 3) Creation of neighbourhood greenspace
- 4) Development of better acoustic insulation
- 5) Improvement of road surfaces
- 6) Adoption of legislation to limit the intensity of background noise

It was recognized that the federal, provincial and municipal governments each play a role in an effective noise control program.

F.2.1 FEDERAL

There is currently no Canada-wide policy for noise abatement. The federal government sets standards for the noise levels produced by trucks and locomotive engines.

F.2.2 PROVINCIAL

Noise is traditionally considered a municipal problem but, in 1971, sound and vibration were defined as contaminants under the Ontario *Environmental Protection Act*. To enforce noise restrictions, municipalities can now use the authority of the *Environmental Protection Act* instead of the less powerful *Ontario Municipal Act*. These new municipal noise by-laws are subject to MOE approval. The EPA provides two model noise by-laws for municipalities:

Part I is a simple qualitative by-law suitable for small municipalities with straightforward noise problems.

Part II is comprehensive by-law with qualitative and quantitative standards.

Quantitative by-laws prohibit noise levels over fixed decibel levels and must be enforced with monitoring equipment. MOE will provide the monitoring for smaller municipalities when needed.

Under the Ontario *Environmental Protection Act*, MOE is also responsible for regulating noise

produced from a point source, railroad or vibration. In 1990, the MOE recieved 25 noise complaints in the Region, dealing mainly with noise and vibrations from quarry blasting.

The Ontario Ministry of Transportation is responsible for regulating noise from provincial roads such as the Queensway.

The MOE and the Ministry of Municipal Affairs are preparing a joint noise policy covering noise from aircraft, roads, railways, sewage and waste treatment facilities, and heavy industry. Once available, it will be incorporated into the MOE environmental protection program as a noise abatement program.

F.2.3 REGIONAL

RMOC is concerned with noise from aircraft, roads, railways and transitways as expressed in the Official Plan of the Region adopted in 1988 and approved by the Minister in 1989. The main concern is that development not receive an unacceptable level of noise in keeping with the Region's goal to 'protect inhabitants from exposure to adverse environmental influences.

The Official Plan contains specific policies for noise including quantitative sound level criteria requiring that specific outdoor areas of residential development meet energy equivalent sound levels (Leq) not exceeding 55 dBA during the daytime and 50 dBA during the night time periods. The Regional Official Plan also directs other local Official Plans to contain policies dealing with the establishment and implementation of acceptable noise levels through the approval of Site Plans.

The Regional Transportation Department is in the process of developing noise control guidelines for new developments adjacent to existing and future Regional Roads and transitway rights-of-ways. These guidelines are currently in a draft stage. These guidelines should provide the necessary detail to enable the RMOC and local municipalities to implement MOE technical guidelines. Compliance with these guidelines by developers is by the honour system. Unfortunately, in the interest of low cost housing, noise control criteria may not be met. There are currently no means of enforcing noise control guidelines.

Early greenspace planning for the Region (See Section III.B.1) facilitates noise control, and large tracts of land along the waterways and greenbelt already serve as transportation corridors. The greenspace along these corridors reduces noise levels in the nearby neighbourhoods. Industrial parks in the greenbelt isolate commercial and residential areas from one another. For the same reason, the airport was located in the greenbelt.

F.2.4 MUNICIPAL

Municipalities are also responsible for considering noise in their approval of other residential development; the criteria for approval are in the official plans of each municipality.

Many common sounds that result in noise complaints are of a local community nature and are best controlled at the municipal level. All municipalities except Kanata and Osgoode have noise by-laws.⁶⁷ Half the by-laws are legislated under the *Environmental Protection Act* and half are legislated

under the *Municipal Act*. Osgoode has a by-law for barking dogs but not for other types of noise. The City of Ottawa has recently passed a more quantitative by-law. Enforcement of these by-laws should aim to ensure that noise problems are corrected before they affect human health. Kanata is in the process of developing a by-law.

For an example of the type of noise complaints dealt with by the municipalities; the Ottawa Police Department received 323 noise reports in 1990, resulting in five charges and 153 reports to May 31, 1991, resulting in two charges. These numbers do not differentiate between type of noise, but basically they fall into three categories:

- 1) Loud parties (private residences)
- 2) Excessive noise from commercial restaurant patios
- 3) Noisy air conditioners

In many of the rural areas, residential development has increased enormously in the last 20 years. New by-laws must take into account not just residential needs, but also the rural character and agricultural activities of the areas.

G ELECTROMAGNETIC FIELDS

In the early 1970s, concern about electromagnetic fields (EMFs) centred on the possible health effects from electric fields. Health effects from electric fields are now considered minor. However, recent studies have suggested that magnetic fields may be a concern. Studies in progress to examine the health effects of EMFs include epidemiological studies, laboratory studies of animals or human volunteers, and biochemical studies.

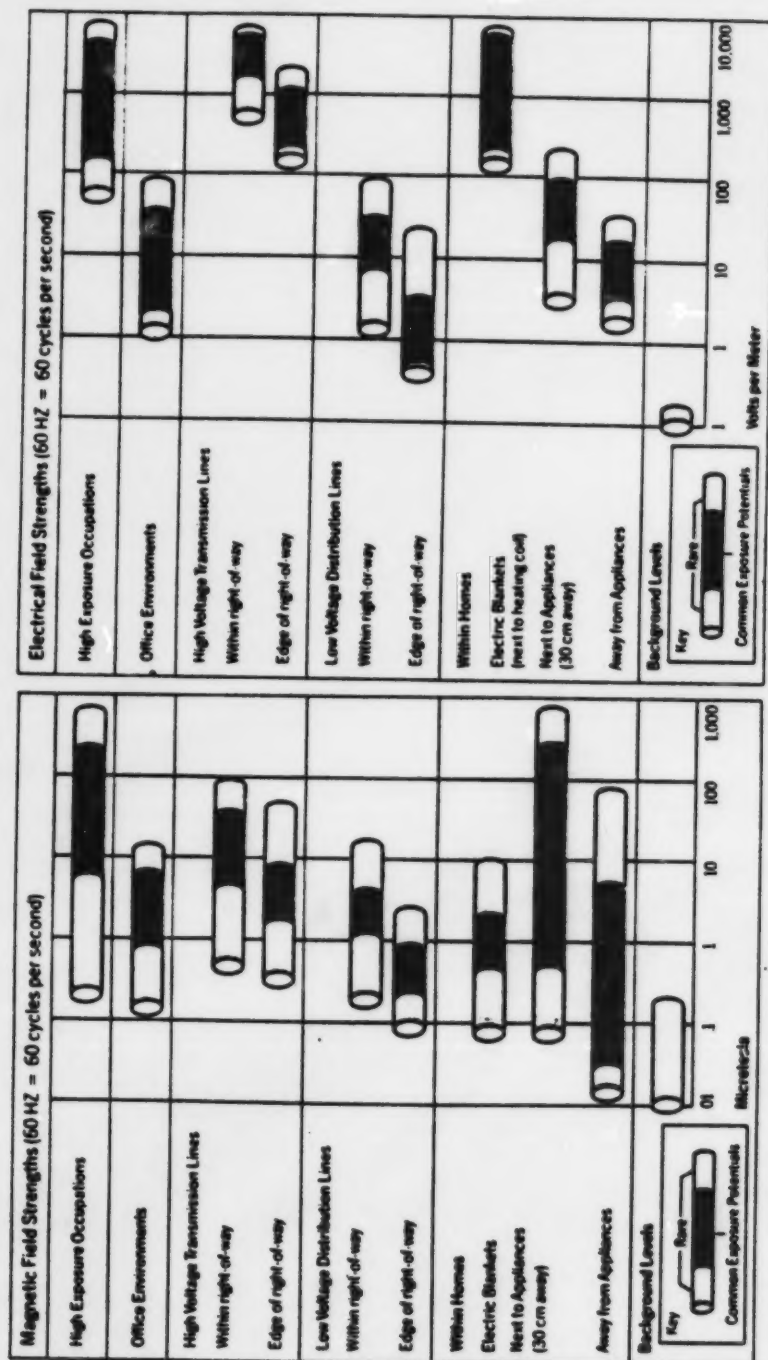
EMF sources range from giant electrical transmission lines to small appliances. Electricity generated at power stations is distributed via high voltage transmission lines (110-735 kilovolts) over long distances to our neighbourhoods and via local distribution lines (110-220 volts) to our homes. Electricity simultaneously generates both electrical and magnetic fields, hence the term electromagnetic fields (EMF). The strength of the electric field is a function of the power line voltage. Electric fields are measured in volts per metre (V/m) or kilovolts per metre (kV/m). The strength of the magnetic field is a function of the current in the power line, measured in microtesla (μT).

In general, electromagnetic fields are most intense at the power line and become weaker with distance. The rate at which the field strength drops off with distance depends on such factors as the phase delay of the power lines (delay between the waves on each line) and the arrangement for ground return (return of the current). Electric fields generated by power lines are blocked by buildings but magnetic fields penetrate buildings. Right-of-ways are the corridors that the power lines run through. For one tower, they are 48 m wide with the towers located in the centre. When two towers are involved, the right-of-ways are 84 m wide, with 36 m between the towers and 24 m between each tower and the edge of the right-of-way. The magnetic field strength at the edge of a high voltage transmission line right-of-way is generally less than 5 μT .

Magnetic fields are also generated inside the home by household appliances, electric blankets and waterbeds. Typical magnetic field levels in the home and at work can range from 0.1 μT to 5 μT . Magnetic fields within 1 foot of small appliances are typically between 1 and 100 μT . The magnetic field strength next to a hair dryer can range from 1000 μT to 2500 μT .¹⁴¹

Figure 38 shows examples of typical magnetic field strengths.¹⁴¹ A profile of a typical EMF exposure through a 24 hour period is given in Figure 39.¹⁴²

Figure 38 Typical Magnetic Field Strengths

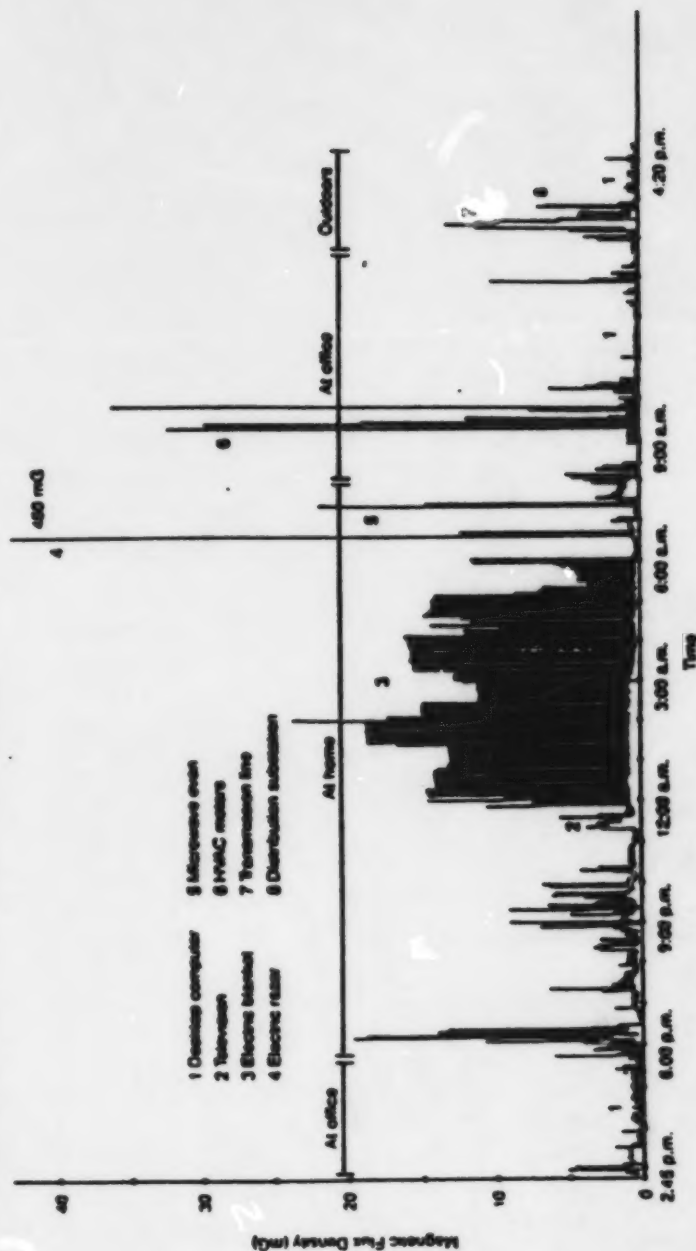


Source: Adapted from West Associates Energy Risk Force Project ET 84-11, July 1986

Figure 39 24 Hour EMF Exposure

EMDEX Profiles Personal Exposure Through the Day

A personal magnetic exposure record taken with the EPRI-developed EMDEX device shows how the magnetic fields an individual experiences can vary through the course of a day. Periods at home show peaks from kitchen appliances and other electrical household items, including a television, an electric blanket, an electric razor, and a microwave oven. At work, fields were recorded as the subject passed building HVAC motors or worked at a desktop computer. Outdoors, the subject walked by neighborhood utility facilities, including an overhead transmission line and a distribution substation. The field levels shown are not necessarily typical of the sources indicated, but the EMDEX profile demonstrates that a great variety of sources contribute to an individual's total magnetic field exposure and that fields from such sources can vary widely.



G.1 HEALTH EFFECTS

G.1.1 EPIDEMIOLOGICAL STUDIES

Epidemiological studies look at human populations for an association between a disease and environmental exposure over time. Although these studies are useful in suggesting a possible cause of a disease, they are not regarded by all scientists as definitive proof because of the many uncontrolled variables. Nevertheless, epidemiological studies are excellent signposts for further, more controlled research.

Two epidemiological studies done in Denver^{143,144} reported an increased incidence of childhood leukaemia in homes close to electric distribution lines. The first study used house wiring codes as an inexpensive way of estimating the magnetic field strength. The second study used both wiring codes and direct measurement of magnetic fields. They found a stronger link between leukaemia and wiring codes than between the disease and magnetic fields. The reason for this is not known and is being examined further.

Preliminary details of a larger, more detailed study were released in February 1991.¹⁴⁵ In Los Angeles County, 232 children under the age of 10 who contracted leukaemia between 1980 and 1987 were studied for a possible link to EMF exposure. This study included more extensive EMF measurements than the previous studies. These preliminary studies suggest:

- 1) No association between electric field exposure and childhood leukaemia.
- 2) A weak, inconsistent association between magnetic field measurements and childhood leukaemia.
- 3) A stronger association between wire codes and childhood leukaemia, supporting previous studies.
- 4) Association between childhood leukaemia and the use of certain household appliances. This data will require further study to verify.

Occupational studies have also examined the link between cancer and work-related exposure to EMFs among electrical workers. Some studies supported an elevated risk for cancer, others did not. There are at least 22 epidemiological studies in progress world-wide on the effects of EMFs on childhood or occupational cancers; these will be completed by 1994.¹⁴⁶

EMF exposure is also implicated in reproductive abnormalities. A 1982 study¹⁴⁷ reported longer gestation periods and lower birth weights in babies born to users of heated waterbeds and electric blankets. Yale University hopes to clarify these results in a study of 4000 pregnant women over the next 3-4 years. Detailed EMF exposure assessments from wiring, appliances and the workplace will be conducted. A pilot study examining the rate of miscarriage among a small group of pregnant women found that as many as 38% used electric blankets and electrically heated waterbeds.¹⁴²

G.1.2 LABORATORY STUDIES

Laboratory studies are conducted under carefully controlled conditions to determine the nature and magnitude of effects suggested by epidemiological studies.

Tumours are currently thought to form in two stages, initiation and promotion. In initiation, an external agent disrupts DNA in a cell, leading to cellular dysfunction. Promoters alter cellular conditions, allowing the dysfunctional cell to grow. Biochemical evidence suggests that EMFs may act as promoters but it is not known how.

EMFs have been shown to alter biological clocks,¹⁴⁸ cellular transport across membranes,¹⁴⁹ and cell growth¹⁴⁹ in experimental biological systems. The mechanism by which EMFs cause these biochemical disturbances or their relationship to human health is not known. Studies on the identification of any carcinogenic mechanisms are ongoing.

G.2 BRIDLEWOOD

In the mid-1980s, Ontario Hydro announced the construction of a high-voltage 500 kV line along an existing right-of-way from Bridlewood in Kanata to the Hawthorne Transformer at the eastern end of Walkley Road. A citizen's group from Bridlewood opposed this development as they were concerned about the location of Bridlewood Public Elementary school near the proposed lines, and the effects exposure to EMFs would have on their children's health.

In May 1988, the Carleton Board of Education sponsored a study by health and safety experts to assess these concerns. Between October 1988 and January 1990, there was no increase in the internal magnetic fields in the school. There was an increase in the external electromagnetic fields that correspond to the changes between the original 230 kV line and the new 500 kV line. However, levels correspond to those predicted by Ontario Hydro and they are well within the magnetic field limits established in Europe (See Section III.G.3). This study is still in progress.

G.3 INITIATIVES FOR IMPROVEMENT

Legislators in Canada are reluctant to set standards at this time without quantitative data correlating health effects with specific field strengths of either transmission lines or electrical appliances. For this reason, Canada does not have health standards for electromagnetic field exposure.¹³⁰ Canada is actively involved in research to determine the health effects of high voltage power lines. Ontario Hydro currently has a five year research program under way which includes an occupational epidemiology study, exposure assessment studies, a small animal study and cellular studies. Participants in the studies include the University of Toronto, Hospital for Sick Children, the British Columbia Cancer Research Centre, Health & Welfare Canada, Hydro-Quebec and Electricite de France. Results from this program are expected in 1993. Meanwhile, efforts are being made to eliminate further increases in public exposure to EMFs in the planning of new high-voltage power lines.

Local utilities are becoming more responsive to residents' concerns and are investigating methods of reducing the magnetic fields from transmission and distribution lines. Most will perform EMF measurements if asked.

In the United States, 7 states have set electric field limits. In 1989, Florida became the first state to add magnetic field limits at the edge of the right-of-way, ranging from 15 μ T (for lines 230 kV and smaller) to 20 μ T for new 500 kV lines. These limits are based on what existing technology can meet, not on health data. In 1990, the International Radiation Protection Association (IRPA) issued interim standards based on 1984 World Health Organization Guidelines. For continuous exposure for the general public, the maximum field exposure is 100 μ T. These standards take into account current research. The field limits correspond to intensities that would induce a current density of 10 milliamperes per square metre in the human body. Other European Countries including Britain, Soviet Union and Germany have similar guidelines.

Residents concerned about electromagnetic fields should contact their local utility for information and have the wiring in their home checked for proper grounding. Electric blankets should only be used for warming the bed and turned off before sleeping. Small appliances with motors or heaters generate large magnetic fields that fall off quickly one metre away, so continuous use at close range should be limited.

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APPENDIX A

PARAMETERS TESTED IN THE DRINKING WATER SURVEILLANCE PROGRAM (DWSP)

Measurements are in mg/L unless otherwise noted.

PHYSICAL

Temperature, °C
Colour, Hazen Units
Turbidity, N.T.U.
Threshold Odour, T.O.N.

CHEMICAL

pH
Total Alkalinity, CaCO₃
Total Hardness, CaCO₃
Magnesium Hardness, CaCO₃
Spec-Cond. Micromhos/cm
at 25°C
Suspended Solids
Dissolved Solids
Total Solids
Langelier Index
Chloride, Cl
Fluoride, F
Aluminum, Al
Ammonium Nitrogen, N
Total Nitrogen, N
Nitrates, N
Nitrites, N
Antimony, Sb

Arsenic, As
Barium, Ba
Beryllium, Be
Boron, B
Cadmium, Cd
Calcium, Cd
Calcium, Ca
Chromium, Cr
Cobalt, Co
Copper, Cu
Cyanide, CN
Iron, Fe
Lead, Pb
Magnesium, Mg
Manganese, Mn
Mercury, Hg
Molybdenum, Mo

Nickel, Ni
Phenols
Phosphates, PO₄
Phosphorus (Total), P
Potassium, K
Selenium, Se
Silica, SiO₂
Silver, Ag
Sodium, Na
Strontium, Sr
Sulphate, SO₄
Thallium, Tl
Titanium, Ti
Total Organic Carbon
Total Inorganic Carbon
Trihalomethanes
Uranium, U
Vanadium, V
Zinc, Zn

MICROBIAL

Standard Plate Count/mL at 37°C
Total Coliforms counts/100 mL
Fecal Coliforms counts/100 mL
Algae, A.S.U./mL

RADIOLOGICAL

Gross-Beta Radioactivity (Bq/L)

APPENDIX B

PARAMETERS TESTED IN THE REGIONAL TRACE ORGANICS DRINKING WATER TESTING PROGRAM

Acenaphthene	trans 1,3 Dichloropropene
Acenaphthylene	Diethyl Phthalate
Acrolein	2,4 Dimethyl Phenol
Acrylonitrile	Dimethyl Phthalate
Anthracene	Di-n-butyl Phthalate
Benzene	Di-n-octyl Phthalate
Benzidene	1,2 Diphenyl Hydrazine
Benzo (a) Anthracene	2,6 Dinitro-o-cresol (2-Methyl 4,6 Dinitrophenol)
Benzo (a) Pyrene	2,4 Dinitrophenol
Benzo (b) Fluoranthene	2,4 Dinitrotoluene
Benzo (e) Pyrene	2,6 Dinitrotoluene
Benzo (ghi) Perylene	Epichlorohydrin (Chloropropylene Oxide)
Benzo (k) Fluoranthene	Ethyl Benzene
Benzylbutyl Phthalate	Fluorene
Benzyl Chloride (a-Chlorotoluene)	Hexachlorobenzene (HCB)
Bis (2-Chloroethyl) Ether	Hexachlorobutadiene
Bis (2-Chloroethoxy) Methane	Hexachlorocyclopentadiene
Bis (2-Chloroisopropyl) Ether	Hexachloroethane
Bis (2-Ethyl Hexyl) Phthalate	Indeno (1,2,3 cd) Pyrene
Bromochloromethane	Isophenone
Bromodichloromethane	2-Methyl 4,6 Dinitro Phenol (4,6 Dinitro-o-cresol)
Bromoform	Napthalene
Bromomethane (Methyl Bromide)	Nitrobenzene
4-Bromophenyl Phenyl Ether	2-Nitrophenol
Carbon Tetrachloride	4-Nitrophenol
4-Chloro -3-methyl Phenol (p-chloro-m-cresol)	N-Nitroso-dimethylamine
Chlorobenzene	N-Nitroso-di-n-propylamine
Chloroethane (Ethyl Chloride)	N-Nitroso-diphenylamine
Chloroethene (Vinyl Chloride)	PCB-1016)
2 Chloroethyl Vinyl Ether	PCB-1221)
Chloroform (Trichloromethane)	PCB-1232)
Chloromethane (Methyl Chloride)	PCB-1242) = Total PCB's
2-Chloronapthalene	PCB-1248)
2-Chlorophenol	PCB-1254)
4-Chlorophenyl Phenyl Ether	PCB-1260)
Chrysene	Pentachlorophenol
Dibenzo (a,h) Anthracene	Phenanthrene
Dibromochloromethane	Phenol
1,2 Dichlorobenzene	Pyrene
1,3 Dichlorobenzene	Styrene
1,4 Dichlorobenzene	1,1,2,2 Tetrachloroethane
3,3 Dichlorobenzidene	Tetrachloroethene (Perchloroethylene)
Dichlorodifluoromethane	Toluene
1,1 Dichloroethane (Ethylidene Chloride)	1,2,4 Trichlorobenzene
1,2 Dichloroethane (Ethylene Dichloride)	1,1,1 Trichlorobenzene (Methyl Chloroform)
1,1 Dichloroethylene (Vinylidene Chloride)	1,1,2 Trichloroethane
trans 1,2 Dichloroethene	Trichloroethene
Dichloromethane (Methylene Chloride)	Trichlorofluoromethane
2,4 Dichlorophenol	2,4,6 Trichlorophenol
1,2 Dichloropropane	o-Xylene
1,3 Dichloropropane	p,m-Xylene
cis 1,3 Dichloropropene	

PESTICIDE/HERBICIDES

2,4-D	Endrin Aldehyde
4,4 DDD	Ethion
4,4 DDE	Frenchlorophos-Ronnel
4,4 DDT	Hepachlor
Aldrin	Hepachlor Epoxide
Ametryne	Hexachlorobenzene
Atrazine	Hexachlorobutadiene
Alpha-Benzene Hexachloride	Hexachloroethane
Beta-Benzene Hexachloride	Malathion
Delta-Benzene Hexachloride	Methoxychlor
Gamma-BHC (Lindane)	Mirex
Captan	O,P-DDT
Carbaryl (1-Naphthyl Methyl Carbanate)	Parathion, Ethyl
Alpha-Chlordane	Parathion, Methyl
Gamma-Chlordane	PCNB
Coumaphos	2,4,5 TP (Silvex)
Diazinon	Strobane
Dichloran	Toxaphene
Dieldrin	PCB (Arachlor)
Endosulphan Alpha	1016
Endosulphan Beta	1221
Endosulphan Sulphate	1232
Endrin	1242
	1248
	1254
	1260